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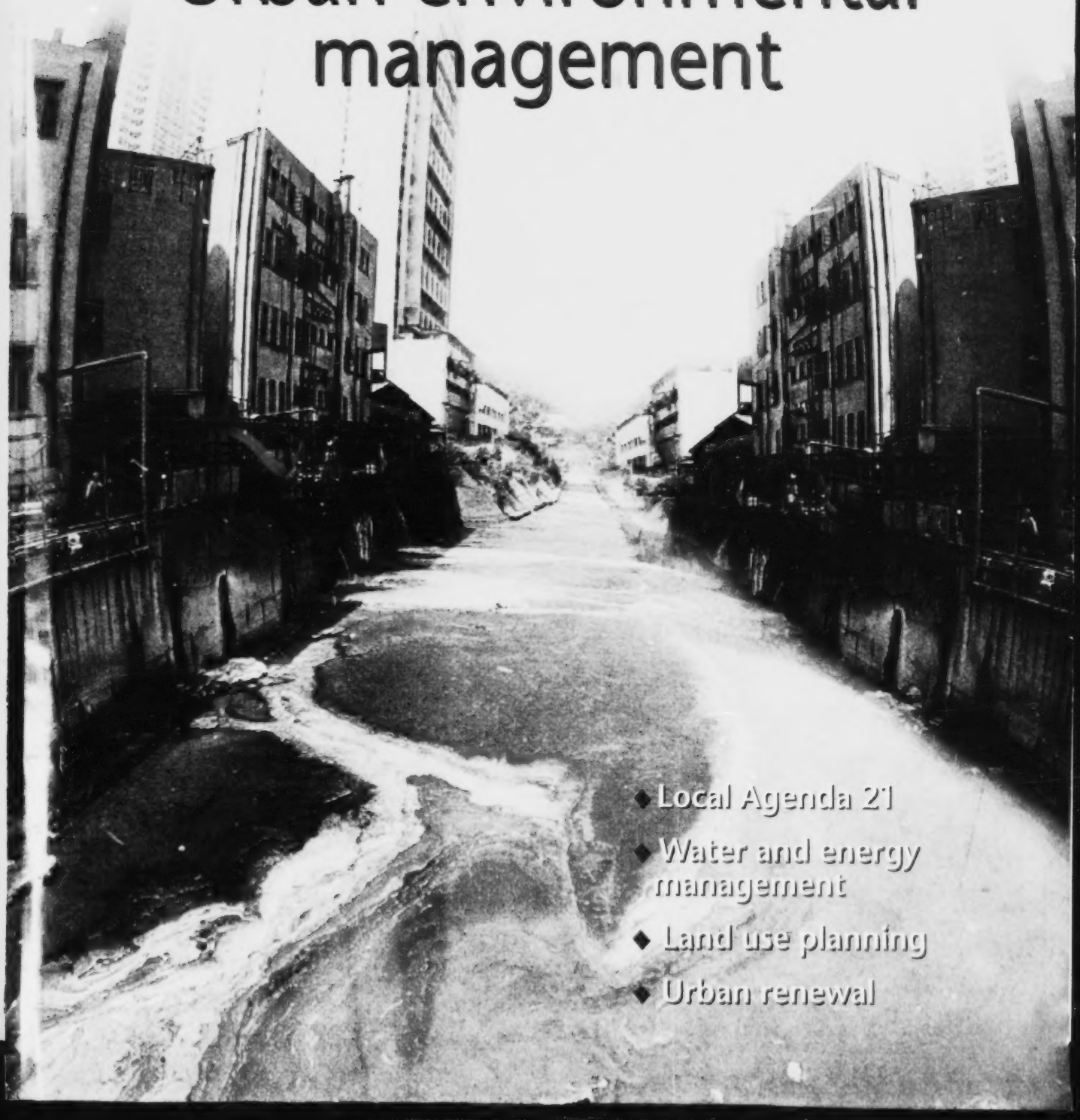
Urban environmental management



- Local Agenda 21
- Water and energy management
- Land use planning
- Urban renewal

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Urbanization: meeting environmental challenges

Urbanization has been the dominant demographic trend during the last half century. Urban environmental management (or UEM) therefore presents increasingly complex challenges. In 1950, some 750 million people lived in urban areas; today there are close to three billion. UEM addresses urban inhabitants, their leaders, and the whole range of responsible officials. It also considers the many sustainability issues faced by urban society - issues that have been highlighted by the UN Habitat conferences. And UEM concerns industry, for instance when it provides urban services or operates in urban areas.

Urban environmental management is about coping with urban problems sustainably. As cities have grown to enormous size, their inhabitants' consumption and production patterns have generated environmental stresses beyond those due to limitations on the land, water and other natural resources required to feed, clothe and shelter them. In addition, there is a need for schools, health facilities, transport and jobs, as well as open spaces in which to enjoy nature, including clean air and water.

Those most negatively affected by the impact of overstressed and overstrained urban resources, especially in developing countries, are the urban poor, who are unable to compete for scarce resources or protect themselves from harmful environmental conditions. Urban poverty is accompanied by many health and environmental problems related to lack of access to basic services (e.g. sanitation, solid waste collection, transport, electricity).

UEM is about factories, offices and households consuming fewer resources to obtain the same goods and services. It is about efficient energy use, for instance through the introduction of efficient, reliable and comfortable mass transit systems, less polluting fuels, and more energy-efficient household appliances, lighting, air conditioning and heating; and it is about producing less waste and promoting recycling. In short, UEM is about respecting nature.

UEM is also about respecting others' right to enjoy nature's bounty. It is about protecting everyone, including the economically and socially disadvantaged, from the harsh impacts of an overstressed environment. It is about social equity and justice with regard to natural resources use. The essence of sustainable development, especially in urban settings, is that no one has the right to abuse or misuse finite natural resources. There is a right to sustainable use, which implies respect for subsequent generations' right to benefit from these resources as well.

UEM is about participation. It is about the obligation of public authorities to engage citizens — the most potent urban stakeholders — in managing resources and addressing environmental concerns. It is about urban managers' duty to ensure that air, soil and water are protected, and to keep citizens informed, consult with them, and defend their interests.

UEM can help avoid urban environmental crises by anticipating the impacts of environmental emergencies. It is therefore a survival kit for urban areas that want to shape events rather than being overtaken by them. Urban environmental management is all this and much more. But it is definitely not about deciding to "wait and see".

The urban areas now practising UEM, and institutionalizing its principles and processes, will be the best prepared to cope with increasing environmental pressures from many different sources.

This issue of *Industry and Environment* highlights a number of UEM tools and instruments. It cannot present them all: for instance, legal, administrative and financing instruments are not included. These instruments would be a good topic for a follow-up issue.

UNEP, with its International Environmental Technology Centre (IETC) in Japan, will continue its contribution to raising awareness and building capabilities of local authorities and other relevant decision makers for a better environmental management of cities. ◆

The urban environment: facts and figures

Urbanization: a growing challenge for the 21st century

Nearly half the world's population lives in urban areas. This proportion will increase in the next few decades, as the long-standing trend towards urbanization continues. As UNEP's *Global Environment Outlook 2000*[1] reports, every year about 60 million people (the equivalent of the population of France) are added to the population of urban areas through rural to urban migration, births in urban areas, and the transformation of villages into cities. The increase in the number of city dwellers, especially in developing countries, parallels the growth of the total world population. Table 1 and Figure 1 show urbanization trends. Almost all current growth in the world population is occurring in developing countries, and urban areas will continue to absorb most of this increase.

The aggregate figures for developing countries hide significant regional differences: in Asia and Africa less than 38% of the population is urbanized, while in Latin America and the Caribbean the figure is almost 75%, about the same as in Europe, North America and Japan. Nonetheless, the combined number of urban dwellers in Europe, North America, Latin America and the Caribbean (1.2 billion) is not as high as that in Asia (1.4 billion), the least urbanized major region today. Urbanization is projected to continue well into the next century. By 2030, nearly 5 billion (61%) of the world's projected 8.1 billion people will live in cities, and Latin America and the Caribbean will actually have a greater percentage of inhabitants living in cities than will Europe. Asia and Africa will both have higher numbers of urban dwellers than any other major region.[2]

As the number and proportion of people in urban areas increases, so do potential environmental problems. This "Facts and Figures" provides information concerning the nature and growth of urban areas, these areas' environmental impacts, and the interrelationship of urbanization, poverty, environmental impacts and sustainability.

Table 1
Population and urbanization growth rates

Major areas	Population (in billions) 1950	1975	2000	2030	Growth rate (%) 1950-2000	2000-2030
Population size and growth						
Total population						
World	2.52	4.07	6.06	8.11	1.75	0.97
More developed regions	0.81	1.05	1.19	1.21	0.76	0.06
Less developed regions	1.71	3.03	4.87	6.90	2.09	1.16
Urban population						
World	0.75	1.54	2.85	4.89	2.67	1.80
More developed regions	0.45	0.73	0.90	1.01	1.41	0.37
Less developed regions	0.30	0.81	1.94	3.88	3.71	2.31
Rural population						
World	1.77	2.53	3.21	3.22	1.19	0.01
More developed regions	0.37	0.31	0.28	0.20	-0.50	-1.19
Less developed regions	1.41	2.22	2.93	3.02	1.47	0.11
Urban indicators						
	Population (in billions)				Growth rate (%)	
	1950	1975	2000	2030	1950-2000	2000-2030
World	29.7	37.9	47.0	60.3	0.91	0.83
More developed regions	54.9	76.0	76.0	83.5	0.65	0.31
Less developed regions	17.8	26.8	39.9	56.2	1.62	1.14

Source: UN Population Division 2000

What is an urban area?

Urban areas take a number of different forms and come in many sizes, from small towns with tightly defined boundaries to sprawling megacities whose low-density suburbs stretch for many kilometres beyond the city limits. The definition of urban areas is established by each national government, which often makes comparisons difficult across national or regional boundaries. In many countries, regions are considered "urban" when they reach a certain population threshold, which may be as low as a few hundred residents (e.g. in Peru or Uganda) or as high as 10,000 (e.g. in Italy or Senegal). Other governments use a combination of criteria, including population density, political organization and economic activity to define urban areas. Some countries have changed their definitions over time, further complicating the task of assessing urbanization rates.[3]

Urban areas are not necessarily cities, although all cities are urban areas. A city has a political, economic, social and cultural identity that many modern urban areas lack. However, urban activities often extend well beyond the city limits. A city's population may vary greatly, depending on how its area is defined: San Francisco, California, for example, has a population within its city limits of only 780,000, but its greater urban area is commonly estimated to include some 7 million people – nearly a 10-fold difference [4]. As in many cities, some of these outlying areas can be described as suburbs that have always been dependent on the main city, while others are separate cities and towns whose own suburbs have stretched to meet those of nearby cities, creating a conurbation that includes numerous municipalities.

The development of urban mass transit and the automobile in the late 19th and early 20th centuries led to the creation of suburbs. Suburban growth exploded in the second half of the 20th century. The rise of megacities, with populations over 10 million, was one of the most striking developments during the last half-century. By 2000, there were 19 megacities (Table 2), although only a small proportion (4.3%) of the world population lives in these cities. Their share of the annual growth of the world's urban population is expected to be moderate, partly because in many such cities environmental conditions drastically reduce the quality of life. Most growth will occur in medium and small cities.

Another major trend is the shift in the location of major population centres from industrialized to developing countries. In 1900, nine of the 10 largest cities were in Europe and the United States. Today, only three of the top 10 – Tokyo, New York and Los Angeles – are in developed countries. Ever-larger proportions of the world's urban population live in so-called "million-plus" cities, especially in developing countries.

According to various estimates, urban settlements in the developing world are growing two to five times as quickly as those in industrialized countries. Many of the same forces that gave rise to urbanization in the industrialized countries – the shift of employment opportunities from agriculture to industry and services, and from rural to urban areas – are driving the current urbanization trend. In some parts of the world, notably Africa, war and other conflicts, land degradation, and exhaustion of natural resources are also factors.

Urban sprawl has become a common feature of modern cities in many parts of the world. Densely populated urban core areas have been augmented or replaced by low- to medium-density devel-

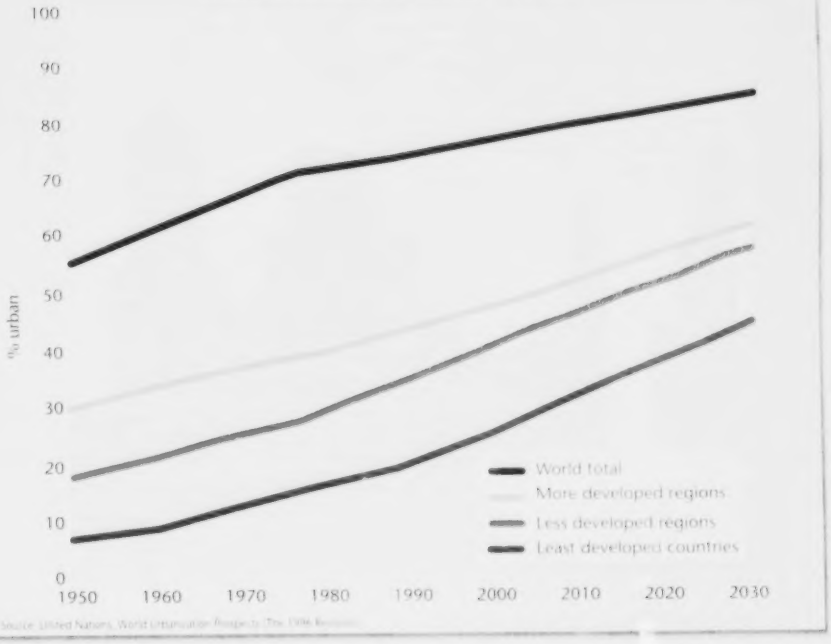
opments, often with multiple smaller concentrations of commercial and industrial activity, leaving major cities increasingly decentralized. However, in some cases cities remain fairly compact since labour and infrastructure are concentrated in inner cities and transport systems are not well-developed. Despite the high visibility of urban sprawl and cities' enormous impact on the natural landscape, most estimates place the amount of land occupied by urban areas at just 1% of the Earth's total land surface.

Cities in many developing countries have been characterized in the past two decades by the growth of squatter settlements or slums surrounding the core of the city. Jakarta's kampongs, Rio de Janeiro's favelas and Lima's barriados are examples of these informal settlements. More than 300 million people live in such slums or shanty towns. These settlements, which have been growing much faster than urban areas overall, now represent a significant portion of the population in many cities in developing countries (e.g. 30-40% in Caracas, Dakar, Dhaka, Lima, Nairobi, Madras, Manila, Rio de Janeiro and São Paolo; 40-50% in Calcutta, Mexico City and Tunis; 50-60% in Bogota, Bombay, Delhi, Buenos Aires, Lagos and Lusaka; 60-70% in Dar-es-Salaam and Kinshasa; and over 70% in Addis Ababa, Cairo, Casablanca and Luanda).[5] Many do not have the most basic services, including sewer connections and safe drinking water supplies, necessary to protect human health and the environment. The overwhelming shelter problem in developing countries, due to the shortage of affordable housing for low-income people, is behind much of the growth in slums and squatter settlements.

Poverty has traditionally been concentrated in rural areas, but this pattern is changing. The World Bank estimates that one-half of the developing world's absolute poor live in urban areas, up from one-quarter in 1988. Recent economic crises and massive rural-to-urban migration have contributed to this growth. Urban poverty is especially pronounced in Latin America, where the number of urban poor surpasses the number of rural poor. The urban poor in this region increased from 44 million in 1970 to 115 million in 1990, while the rural poor increased from 75 million to 80 million during the same period. A growing number of the urban poor are also homeless in both developed and developing countries; according to current estimates, the homeless population is over 100 million.

The urban poor often suffer most from urban environmental hazards because of the conditions in which they must live. They may occupy squatter settlements or heavily polluted industrial areas. Habitat estimates that at least 600 million urban dwellers in Africa, Asia and Latin America live in "life-and-health threatening homes" and neighbourhoods, so-called because of very poor housing and living conditions and the lack of adequate provision for sanitation, drainage, garbage removal and health care.[6] The poor are also more likely to live in industrial areas, as they are often constrained by lack or unaffordability of transport to live near their workplaces. When industrial facilities and homes are close together, the risk from industrial accidents is increased.

Figure 1
World urbanization trends, 1950-2030



Source: United Nations, World Urbanization Prospects: The 1996 Revision

Table 2
Population of cities with 10 million inhabitants or more, 1950, 1975, 2000 and 2015 (in millions)

1950		1975		2000		2015	
City	Population	City	Population	City	Population	City	Population
1 New York	12.3	1 Tokyo	19.8	1 Tokyo	26.4	1 Tokyo	26.4
		2 New York	15.9	2 Mexico City	18.1	2 Bombay	26.1
		3 Shanghai	11.4	3 Bombay	18.1	3 Lagos	23.2
		4 Mexico City	11.2	4 São Paulo	17.8	4 Dhaka	21.1
		5 São Paulo	10.0	5 New York	16.6	5 São Paulo	20.4
				6 Lagos	13.4	6 Karachi	19.2
				7 Los Angeles	13.1	7 Mexico City	19.2
				8 Calcutta	12.9	8 New York	17.4
				9 Shanghai	12.9	9 Jakarta	17.3
				10 Buenos Aires	12.6	10 Calcutta	17.3
				11 Dhaka	12.3	11 Delhi	16.8
				12 Karachi	11.8	12 Metro Manila	14.8
				13 Delhi	11.7	13 Shanghai	14.6
				14 Jakarta	11.0	14 Los Angeles	14.1
				15 Osaka	11.0	15 Buenos Aires	14.1
				16 Metro Manila	10.9	16 Cairo	13.8
				17 Beijing	10.8	17 Istanbul	12.5
				18 Rio de Janeiro	10.6	18 Beijing	12.3
				19 Cairo	10.6	19 Rio de Janeiro	11.9
						20 Osaka	11.0
						21 Tianjin	10.7
						22 Hyderabad	10.5
						23 Bangkok	10.1

Source: UN Population Division 2000

A double-edged sword

Urbanization has both benefits and drawbacks for humans and the environment. It has historically been accompanied by better incomes and living conditions, increased education levels, and a variety of other social, cultural and health benefits. Well-planned, densely populated settlements can reduce the need for land conversion; provide opportunities for energy savings and make recycling more cost-effective. If cities are properly managed, particularly with adequate attention paid to social development and to environmental issues, they can avoid the problems so clearly visible in the urbanization process currently under way in the countries of the South.

However, in most of the developing world current urban growth is not well-managed and leads

to major environmental and health problems, mainly associated with poverty. Many cities in the developing countries, already facing huge inadequacies in shelter, infrastructure, transportation and services, also struggle with insufficient water supplies, deteriorating sanitation and related environmental pollution. The World Bank describes the growth of the urban population as a "double-edged sword" with regard to health and sanitation. Although it is easier to provide water and sanitation services to people living closer together, the costs of meeting their needs grows both in absolute terms and per capita. The health risks presented by inadequate sanitation increase exponentially as population density rises and people share drinking water and sanitation resources.[7] Poorly planned and managed cities are also inconvenient to move around in and eco-nomically inefficient, reducing the potential advantages of urbanization.

Major environmental issues associated with urban areas

Urban environmental impacts stem from the use of resources, including land, water and energy; waste and wastewater treatment and disposal practices; and both industrial and domestic use of chemicals. The nature and severity of impacts are strongly influenced by the wealth and consumption patterns of a city's inhabitants (Figure 2).

Resource consumption

Large concentrations of people and activities use far more resources than the immediate region can provide, requiring that food, fuel, and often water be transported great distances to supply their needs and contributing to transportation-related impacts such as air pollution.

All cities and city-dwellers consume a large share of natural resources, but, not surprisingly, there tends to be much higher consumption per capita in wealthier cities. Because of their intensive use of resources and generation of large quantities of waste, cities can have impacts far beyond their local areas. The concept of "ecological footprints" illustrates this phenomenon. London's ecological footprint, for example, considering only its consumption of food and forest products and the area needed to absorb its CO_2 emissions, is calculated to be 125 times larger than the city area itself.[8]

Land use

As cities grow larger, an increasing amount of the surrounding land, which may once have been used for agriculture or provided natural habitat for wildlife, is taken over for housing, roads, industry and commercial uses. Urban sprawl, with its low-density development, eats up large amounts of land and can be especially damaging to the environment since it is associated with greater use of motorized transport and correspondingly higher fuel consumption and air emissions. However, the high residential densities typical of urban areas also offer an opportunity to reduce the impacts of land conversion in areas of rapid population growth because of the smaller amount of land needed for each person.

Not only the amount but also the type of land affected by conversion to urban uses is important. Cities are often located in areas of prime agricultural land or in sensitive ecosystems, such as along coastlines and waterways. When agricultural land in such areas is converted to urban uses, it puts additional pressure on nearby areas that may not be as suitable for agriculture or may be damaged by the increased agricultural intensity needed to compensate for lost food production. A Canadian study has shown that it takes about 3 hectares of prairie land to replace each hectare of prime farmland converted to urban use in Ontario, increasing the total rate of land conversion. Land conversion often occurs on land that is not well-suited to urban development, such as steep slopes, making it vulnerable to erosion and landslides. Coastal areas, especially wetlands, are rapidly being developed throughout the world (Table 3). The filling, paving, building and pollution associated with coastal development often lead to loss of important wildlife habitat. They also alter the hydrology of coasts and estuaries and destroy coastal features like reefs, beaches and mangrove swamps that serve as barriers to erosion and storm damage.

Squatter dwellings in Nairobi, Kenya. Collins Omondi/MYSA Shootback 1999.

Water use

Water resources are a major issue for many urban areas, especially in megacities and cities that are growing very rapidly. Rural water use, especially for agriculture, is far greater in the aggregate than urban use, but per capita water use is greater in urban areas. Urban water consumption ranges from 50-100 liters per person per day (lpd) in developing countries in Africa, Asia and Latin America, to 300-600 lpd in North America and Europe.[9] Table 4 compares water use per person in various cities.

The intensity of demand in fast-growing cities can quickly exceed local water supplies. Poor management and pollution of water resources put pressure on both the quality and quantities of water supplies. The price of water is typically much lower than the actual costs of obtaining, treating, and distributing it, partly because of government subsidies. Households and industrial users therefore have little incentive to conserve water. Many water distribution systems, especially in the developing world, lose large amounts of

> During the course of history, urbanization has been associated with economic and social progress, the promotion of literacy and education, the improvement of the general state of health, greater access to social services, and cultural, political and religious participation. Democratization has enhanced such access and meaningful participation and involvement for civil society actors, for public-private partnerships, and for decentralized, participatory planning and management, which are important features of a successful urban future. Cities and towns have been engines of growth and incubators of civilization and have facilitated the evolution of knowledge, culture and tradition, as well as of industry and commerce. Urban settlements, properly planned and managed, hold the promise for human development and the protection of the world's natural resources through their ability to support large numbers of people while limiting their impact on the natural environment. The growth of cities and towns causes social, economic and environmental changes that go beyond city boundaries.
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> ....
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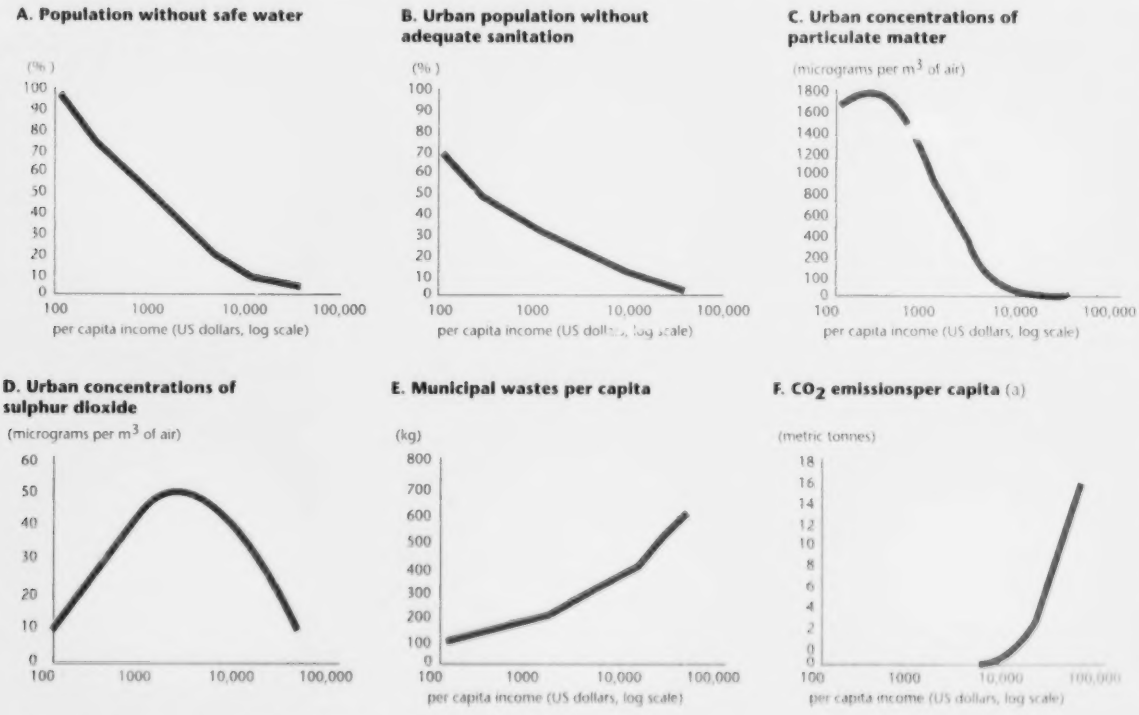
> Increasingly, cities have a network of linkages that extends far beyond their boundaries. Sustainable urban development requires consideration of the carrying capacity of the entire ecosystem supporting such development, including the prevention and mitigation of adverse environmental impacts occurring outside urban areas. The unsafe disposal of waste leads to the degradation of the natural environment: aquifers, coastal zones, ocean resources, wetlands, natural habitats, forests and other fragile ecosystems are affected, as are the homelands of indigenous people. All transboundary movements of hazardous waste and substances should be carried out in accordance with relevant international agreements by parties to those agreements. Rapid urbanization in coastal areas is causing the rapid deterioration of coastal and marine ecosystems.
>
> The Habitat Agenda

water to leaks and illegal connections. These losses may represent as much as 20-50% of public water supplies.[10] Pollution from urban runoff and discharges of untreated industrial effluents and sewage have adversely affected many urban lakes and rivers, leaving cities with unsafe water supplies and forcing them to bring water long distances to replace degraded local sources. Cities that use groundwater for their municipal water supply commonly withdraw the water much faster than it can be replenished naturally, leading to falling water tables and often to land subsidence causing structural and flood damage. China, the Middle East and the Indian subcontinent are particularly susceptible to water shortages and conflicts. These regions may face unmanageable pressures on water resources if present rates of population and demand growth continue.

In 1994, about one-half the urban population in developing countries had water piped into their houses, and around one-quarter had non-private sources of supply such as public standpipes, yard taps, protected dug wells and bore-holes with hand-pumps. The number of urban dwellers without suitable water services was estimated at 279 million (Table 5). The actual number of people inadequately served is probably greater, however, since definitions of what constitutes an adequate amount of safe drinking water vary from country to country. Many governments classify the supply as "adequate" when there is a water tap within 100 metres of a house, but the existence of

Figure 2
Environmental indicators at different country income levels, 1980s



Source: The World Bank, World Development Report 1992 (The World Bank, Washington D.C., 1992), Figure 4, p. 11
Notes: Estimates are based on cross-country regression analysis of data from the 1980s (a) Emissions are from fossil fuels

Table 3
Distribution of cities with more than 500,000 residents in coastal and non-coastal areas, 1995

Region	500,000 to 1 million residents		1 million to 10 million residents		More than 10 million residents	
	Coastal	Non-coastal	Coastal	Non-coastal	Coastal	Non-coastal
World	124	214	108	159	6	2
Africa	12	31	13	14	0	0
Asia	61	102	59	88	5	1
North America	8	12	4	4	0	0
Central America	6	9	3	8	0	1
South America	17	10	12	10	1	0
Europe	16	20	8	15	0	0
Former Soviet Union	4	30	4	20	0	0
Oceania	1	0	5	0	0	0

Source: Compiled by the World Resources Institute from the following: World Cities Population Database (Birkbeck College, University of London, London, 1990); United Nations Population Division, *Urban Agglomerations Ranked in 1992* (UN, New York, 1994); UNEP and World Health Organization, *Urban Air Pollution in Megacities of the World* (Blackwell Publishers, Oxford, UK, 1992).

Notes: City populations are standardized at a common year (1995). Urban agglomeration data reported by the United Nations often include several cities within a densely populated area. In this table, these agglomerations have been subdivided into their smaller administrative units. Therefore, the number of cities of a certain population may not correspond to United Nations population data used elsewhere in this report.

such a tap does not guarantee that an individual household will be able to secure enough water to maintain good health and hygiene.

Energy use

Urbanization, together with the intertwined phenomena of population growth, industrialization and economic development, is one of the major factors in the long-term increase in global energy use. Urban dwellers rely heavily on fossil fuels and electricity, although biomass fuels are still important energy sources in many cities in the developing world. Energy use per capita is much less in the developing world (Table 6).

In developing countries, rural residents tend to use less energy per capita than urban residents. In industrialized countries, rural residents typically use more energy per capita than do city dwellers. This is true partly because of the efficiencies of scale possible in densely developed areas, and partly because energy-intensive industrial and manufacturing activities are more likely to be located outside cities in developed countries, while these are still largely urban – and rapidly expanding – activities in developing countries.[11]

In areas where biomass fuels, especially charcoal, are extensively used, they contribute to local deforestation and associated problems of erosion, land degradation and habitat loss. They also have health impacts, especially where charcoal is commonly used for cooking, as in many parts of Asia and Africa (see *Air Pollution and Global Warming* below). Traditional cooking methods also have very low efficiency rates, converting only about 10-15% of the energy contained in the fuelwood into useful energy in the pot.[12]

Solid waste

The concentration of domestic and industrial wastes is much greater in cities than in rural areas, both because of the large number of people living in a relatively small area and because urban populations tend to consume more than rural ones. Wealthy cities tend to produce far more waste than poor ones (Table 7). The composition of waste changes as incomes rise, with a lower proportion of biodegradable organic wastes and more plastics and other synthetic materials that decompose slowly.

Solid waste disposal creates environmental problems in two main ways. First, much of it is not collected in cities in the developing world, where the rate of solid waste collection is often only 30-50%. The remainder is burned or dumped in uncontrolled landfills or left in the streets, where it creates health hazards and blocks drains, contributing to urban flooding.

Second, the portion of the waste collected also creates environmental problems because of deficiencies in waste management practices. Household and industrial wastes, including toxic ones, are often handled together, leading to soil and groundwater pollution when these wastes are dumped in improperly sited and constructed landfills. Illegal dumping and improper disposal of toxic wastes are common in developing countries and contribute to local water and soil degradation, as well as posing health threats to local residents.[13] In industrialized countries, long-established major urban areas are beginning to run out of suitable landfill sites.

Table 4
Water use in selected cities, 1994-96[a]

City	Consumption (lpd)
Beijing	251
Delhi	248
Gaborone, Botswana	236
Israel (average, all urban areas)	110
Lviv, Ukraine	74.8
London	177
Los Angeles	150
Mexico City	364
New York	680
Sydney	460

[a] Data is for most recent year available.

Source: UNESCO 1999

Wastewater collection and treatment, water pollution

The lack of adequate sanitation services is one of the greatest threats to human health in the developing world. It is a major contributor to the pollution and degradation of water resources. UNCHS (Habitat) estimates that at least one-third of the South's urban population had no provision for sanitation in 1991 and was forced to resort to open defecation on land or in waterways. Of those that did, most had only a simple latrine; some 550 million had a house connected to a public sewer and around 220 million had a septic tank system. Estimates for 1994 suggest that the number of urban dwellers in the South lacking adequate sanitation had increased to 588 million, up from 452 million in 1990 (Table 5). By 2000, the total number of people without adequate sanitation is expected to reach 3.31 billion, more than one-half the world population. This figure includes 846 million urban dwellers. As with the statistics on water supplies, estimates of the number of urban dwellers without adequate sanitation are probably low since they do not reflect the actual functioning or use of the facilities.

While some 62% of high-income urban residents in developing countries have sewer connections, only 8% of urban low-income dwellers do. Low-income families must often share latrines with 100 or more other people, and long lines or overflowing tanks deter residents from using them at all.[14] Figure 3 gives some examples of the disparity in levels of service between rich and poor.

Poor sanitation creates health and environmental hazards in several ways, including direct exposure to feces near homes, contaminated drinking water, and consumption of fish from polluted waters and produce fertilized by wastewater.

Even where sanitation provisions exist, often they do not guarantee protection of health and the environment. Domestic wastewater is the main cause of water quality degradation in the developing world, where more than 90% of sewage is discharged directly to rivers, lakes and coastal waters without any kind of treatment. In India, for example, according to WRI, only eight of 3119 towns and cities have full wastewater collection and treatment facilities, while another 209 have partial treatment facilities. Even in higher-income developing countries, only a small percentage of the wastewater collected by sewage systems is treated before discharge to waterways.

Domestic wastewater treatment is still a problem in wealthier regions as well, although not to the same extent as in developing countries. OECD surveys have found that approximately one-third of the population of member countries is not served by wastewater treatment plants. Many cities with older sewerage collect wastewater and storm water together, allowing untreated wastewater to be released through overflow drains when rainfall is heavy.

Water supplies that have been contaminated by poor sanitation practices are the main pathway for the intestinal diseases, transmitted by feces, that are so common in developing countries. Two of these diseases, diarrhea and intestinal worm infec-

tions, account for approximately 10% of the total burden of disease in developing countries. The World Bank estimates that 2 million fewer children would die from diarrheal diseases each year if everyone had access to adequate water and sanitation facilities. Diarrheal diseases alone killed over 3 million children in 1993. They cause nearly 2 billion cases of illness annually.

Air pollution and global warming

Air pollution released from industrial, energy and vehicular sources is one of the most noticeable environmental features of many urban areas. It is especially severe in megacities like Beijing, Seoul, Mexico City and Cairo; in each of these cities the air quality does not meet World Health Organization (WHO) guidelines for at least two of the pollutants that WHO monitors. Table 8 compares air pollution indicators in major cities. More than a billion people around the world live in urban areas with unhealthy air, most of them in developing countries. While urban air quality in developed countries has generally improved over the past two decades, it has become worse in the developing world and the formerly socialist economies.

Improved air quality in developed countries is mainly a result of improved emissions control technologies and more stringent emission standards for stationary sources such as power plants. However, increasing motor vehicle use, partly necessitated by urban sprawl, now poses the greatest threat to air quality. Urban air quality in developing countries is also affected by increasing motor vehicle use, especially since vehicles are often poorly maintained and leaded fuel use remains common. Private vehicle ownership is growing rapidly, along with personal incomes and living standards in many transition economies. These countries are also experiencing increasing industrial activity and demands for greater power generation, often using older, more polluting technologies that have largely been phased out in wealthier countries. Urban air quality in developing countries seems likely to worsen without strict pollution control measures.

Air emissions from motor vehicles are a major contributor to ozone depletion. They also contribute to widespread increases in airborne lead levels and in lead-contaminated soil. Vehicles that use leaded fuel account for up to 95% of airborne lead pollution in cities in developing countries. Lead is highly hazardous to human health, especially that of children, in whom lead exposure causes brain damage, reduces intelligence, and is implicated in behavioural and physical problems (Figure 4). Many cities in developing countries, such as Cairo and Bangkok, have ambient airborne lead levels of 1.5 micrograms per cubic metre, two to eight times the levels common in most North American and European cities. Lead levels tend to be especially high along roads with high traffic density, like those in urban areas.

The World Bank estimates that air pollution levels above WHO guidelines cause between 300,000 and 700,000 premature deaths per year. Air pollution also contributes to chronic and infectious respiratory diseases and can cause permanent respiratory damage. Its economic impacts arise mainly from productivity losses due to ill health (Figure 5), but at the local level urban air pollution damages not only human health but also crops, vegetation and buildings. Globally, cities are also among the major contributors to regional and global air pollution and to emissions of greenhouse gases.

Indoor air pollution is also a major health problem in urban areas of the developing world. Many people still rely for cooking and heating on low-quality biomass fuels, such as charcoal or animal dung, which provide 50% and 90%, respectively, of domestic energy supplies in the smaller urban areas of Asia and Africa. Women and young children, who often spend much time indoors and cooking over open fires, may experience greater exposure to pollutants from indoor than outdoor air.

Table 5
Water and sanitation coverage by region, 1994

	Population in millions			
	Total population	Population served	Population unserved	% coverage
Global				
Urban water	1594	1315	279	82
Rural water	2789	1953	838	70
Total water	4383	3268	1115	75
Urban sanitation	1594	1005	589	83
Rural sanitation	2789	505	2284	18
Total sanitation	4383	1510	2873	34
Africa				
Urban water	239	153	86	88
Rural water	468	173	295	37
Total water	707	326	381	46
Urban sanitation	239	131	108	66
Rural sanitation	468	112	356	24
Total sanitation	707	243	464	34
Latin America and the Caribbean				
Urban water	348	36	42	88
Rural water	125	70	55	56
Total water	473	376	97	79
Urban sanitation	348	254	94	73
Rural sanitation	175	42	83	34
Total sanitation	473	296	177	63
Asia and the Pacific				
Urban water	955	805	150	84
Rural water	2167	1690	477	78
Total water	3122	2495	627	80
Urban sanitation	955	584	371	81
Rural sanitation	2167	332	1835	15
Total sanitation	3122	916	2206	29
Western Asia				
Urban water	52	51	1	98
Rural water	29	20	9	69
Total water	81	71	10	88
Urban sanitation	52	36	16	69
Rural sanitation	29	19	10	66
Total sanitation	81	55	26	68

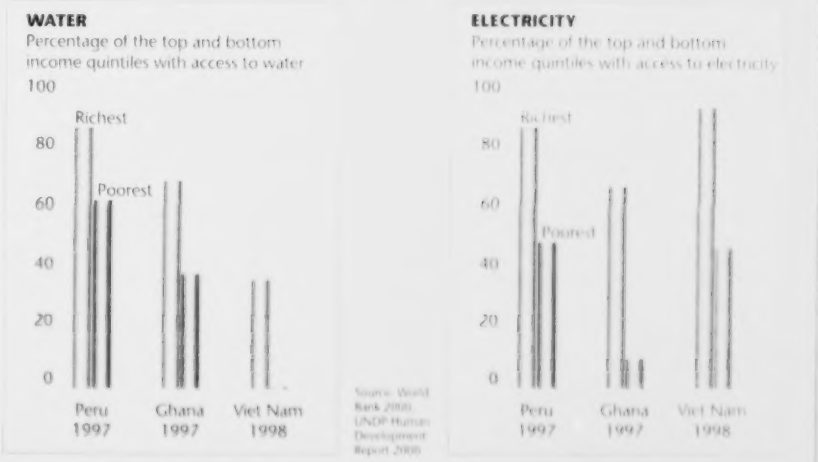
The first parameter, service coverage, measures the population having access to functioning safe water supplies and adequate excreta disposal facilities. Coverage is further broken down into the different water supply technologies (house connections, yard taps, public standpipes, etc.) and sanitation facilities (public sewers, septic tanks, latrines, etc.).

Source: WHO/UNICEF Joint Monitoring Programme, Water Supply and Sanitation Sector Monitoring Report 1996

Brownfields

Many cities, especially in industrialized countries, are trying to cope with the problem of environmentally blighted sites often called brownfields – abandoned, vacant or underused former industrial facilities where redevelopment is hampered by real or perceived environmental problems. Management of these sites often falls to city governments. Over the last several years, considerable attention has been paid to brownfield sites, which are often located in areas that would otherwise be desirable for infill development. The potential costs of environmental liability associated with brownfield properties discourage developers and contribute to a number of urban problems.

Figure 3
Disparity by income – public services favour the rich



Source: World Bank 2000; UNDP Human Development Report 2000

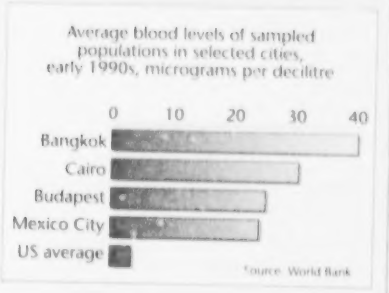
Table 6
World energy use trends

	Traditional fuel consumption[a] (as % of total consumption)		Commercial energy use (oil equivalent) Total (1000 metric tonnes)		Per capita (kg)	
	1980	1995	1980	1994	1980	1994
All developing countries	22	15	1,280,811	2,449,513	393	568
Least developed countries	77	84	19,166	27,540	53	53
Industrialized countries	1	3	4,919,887	5,467,912	4587	4452
World	7	7	6,200,698	7,917,425	1431	1429

a. Data are omitted for countries deriving less than 20% of household energy from fuelwood

Source: UN 1997

Figure 4
Blood lead levels



including sprawl, urban blight, lost local tax revenues and crime.

Brownfield redevelopment is complicated by the fact that it usually requires the participation and coordination of multiple public and private entities, as well as expertise in a variety of disciplines including environment, economic development, infrastructure, planning, financing and community development. Local governments have historically controlled brownfield redevelopment because of their responsibility for land use decisions, but they often lack the expertise or financial means to complete the complicated site assessments, toxicology studies and clean-up needed. In addition, brownfield communities often face other problems such as unemployment, substandard housing, or outdated public infrastructure.[15]

Brownfield redevelopment can ease pressure conversion of other land types to urban uses. Successful programmes have emphasized the inclusion of the private sector in redevelopment activities and the creation of a business climate and incentive structure that encourage brownfield redevelopment over development of suburban, agricultural or wild land.

Natural and industrial disasters

The vulnerability of urban populations to both natural disasters and industrial accidents is growing, due to population increase and inadequately planned urbanization. The number and density of people living in cities within earthquake and tropical cyclone zones have risen dramatically in the past two decades. Globally, natural disasters appear to be becoming more frequent and their effects more severe. Poor planning decisions have also led to siting of potentially hazardous facilities such as nuclear power plants, chemical factories and major dams in earthquake zones and densely populated areas. Accidents related to transport of hazardous goods or to hazardous industries located in cities also have impacts on both the environment and health.[16] Local planning for disaster management can avoid many industrial accidents and reduce the toll of both accidents and natural disasters (see article in this issue on "Community Planning for Disasters").

Urban planning and the environment

Land use planning and management, long practised in cities in the developed world, works very poorly in the developing world, where formal planning and controls are inadequately formulated and managed and large sections of cities often grow haphazardly with little concept of or concern for the eventual result. Urbanization rates in many countries exceed the capacity of national and local governments to plan urban growth and provide services and housing for more than a small fraction of the newly urban population. As a result, new forms of urban poverty have emerged, characterized by poor housing conditions, insecure land tenure, urban crime and homelessness, with consequent negative impacts on the environment.

In most countries in Africa, Asia and Latin America, the level of resources available to local governments is inadequate to provide even the most minimal level of services. In some cases, governments may be unwilling to provide services since they do not wish to legitimate what they consider as illegal development. Squatter settlements are usually located on otherwise unwanted land, which may be located in wetlands, floodplains or steep slopes – where urban development is both vulnerable to and increases the risks of erosion, mudslides and flooding.

In both developing and industrialized countries, cities often seem to be made for vehicles, not people. Many cities in the developing world lack pavements, so pedestrians must make their way in the dust or mud lining the streets, avoiding badly designed and sited urban services and hazarding the traffic. Urban design and planning, and use of environmental management systems, as well as the cooperation of utilities and private landowners, are necessary in order to create cities that are enjoyable as well as functional.[17]

Table 7
Municipal waste – quantities and characteristics for low-, middle- and high-income countries

	Low-income countries	Middle-income countries	High-income countries
Waste generation (kg per person per year)	100-220	180-330	300-1000
Moisture content (% net weight at the point of generation)	40-80	40-50	20-40
Composition (% by net weight)			
Paper	1-10	15-40	15-50
Glass, ceramics	1-10	1-10	4-12
Metals	1-5	1-5	3-13
Plastics	1-5	2-6	2-10
Leather, rubber	1-5	-	-
Wood, bones, straw	1-5	-	-
Textiles	1-5	2-10	2-10
Vegetables/putrescibles	40-85	20-65	20-50
Miscellaneous inerts	1-40	1-30	1-20

Sources: Habitat 1996, based on Sandra Cointreau, *Environmental Management of Urban Solid Waste in Developing Countries*, Urban Development Technical Paper N° 5, The World Bank, Washington D.C., 1982. The ranges of waste generation in low- and high-income countries have been extended, reflecting new data on municipal waste generation in different cities.

Sustainable cities: from concept to reality

Cities will continue to play a central role in the world's economy and environment, and in the lives of more than half the world's people, making the sustainability of cities essential to sustainable development overall. Many of the environmental problems mentioned above are the result of poor management and planning rather than of the urbanization process itself. Because of cities' broad ecological footprint, their problems must be addressed at the regional, national and international levels, as well as at the municipal level. Developing the institutional structure required is perhaps the most difficult aspect of managing urban development. Habitat's Local Agenda 21 initiatives have proved effective in developing and implementing sustainable urban development policies that involve community members and governments alike. Some of these initiatives are described in articles in this issue of *Industry and Environment*.

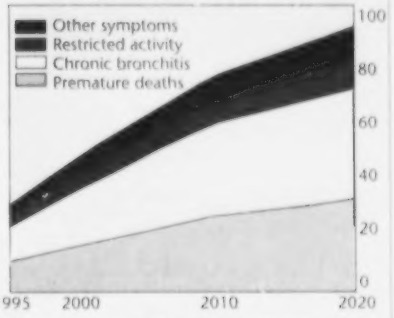
There are several obvious ways that cities' ecological footprints can be reduced:

- increase the efficiency of use of resources such as water, fossil fuels, and wood and mineral resources;
- reduce waste generation and increase recycling and reuse of wastes, for example by using organic waste for compost or treated wastewater for urban agriculture;
- increase production of biomass, such as crops, gardens and trees, in the city and its surroundings.[18]

A number of cities have taken steps towards better planning and environmental management, notably by involving local communities. For example, in Bogota each of the 20

municipalities that make up the metropolitan area has developed a local environmental agenda that identifies its environmental resources and problems. These are used not only to address local conditions, but also to feed information into regional city planning functions and to allow districts with comparable problems to work together in solving them.[19] Hyderabad, faced with inadequacies in its centrally managed garbage collection programme, set up neighbourhood residents' associations to manage garbage collection. These associations improved the rate of collection while greatly reducing the cost.[20] And Albertslund, Denmark, addresses environmental impact reduction at both the municipal and household level. The city has set goals and timeframes for reduction of resource use and CO_2 emissions, increased use of organically produced food in public institutions, and development of outdoor recreation areas, among others. At the same time, it has established a grassroots programme that encourages households to conserve energy and reduce waste generation.[21]

Figure 5
Health costs* of urban air particulate pollution 1995, $bn



* Social costs of mortality and morbidity due to exposure to PM10

Source: World Bank

These examples illustrate the importance of focusing urban planning and management on local conditions and needs. There is no viable "one size fits all" approach. The urbanization process in developing countries has some similarities to the process that has already taken place in the developed world, but there are also many differences. Some experiences are transferable, but many are not. Above all, there are many aspects of local culture that can help or hinder urban environmental programmes.[22] The problems of the physical environment can be managed only with an adequate understanding of economic, social and cultural environments that contribute to them.

Table 8
Urban air pollution in selected cities, 1995

City	City population (thousands)	Total suspended particulates (mg/m^3)	Sulphur dioxide SO_2 (mg/m^3)	Nitrogen dioxide NO_2 (mg/m^3)
Accra	1673	137	..	..
Athens	3093	178	34	64
Beijing	11,299	377	90	122
Cairo	9690	..	69	..
Cape Town	2671	..	21	72
Copenhagen	1326	61	7	54
Kuala Lumpur	1238	85	24	..
Los Angeles	12,410	..	9	74
Manila	9286	200	33	..
Melbourne	3094	35	0	30
Mexico City	16,562	279	74	130
Montreal	3320	34	10	42
Moscow	9269	100	109	..
Mumbai	15,138	240	33	39
Rome	2931	73	..	..
São Paulo	16,533	86	43	83
Seoul	11,609	84	44	60
Sofia	1,188	195	39	122
Tehran	6,836	248	209	..
Tokyo	26,959	49	18	68
Zurich	897	31	11	39

a. Data are for the most recent year available in the period 1990-95. Most are for 1995.

Sources: WHO Healthy Cities Air Management Information System and WRI 2000

Notes

1. UNEP (2000) *Global Environment Outlook 2000*, p. 47.
2. UN Population Division (2000) *World Urbanization Prospects: The 1999 Revision, Key Findings*.
3. World Resources Institute (WRI) (1966) *World Resources 1996-97*, ch. 1.
4. Association of Bay Area Governments, on-line statistics, 2000.
5. Habitat Tools and Statistics Unit, on-line statistics, 2000.
6. Habitat (1996) *Global Report on Human Settlements*.
7. World Bank (1999) *Poverty Matters*, on-line document.
8. UNEP, op. cit., p. 47.
9. UNESCO (1999) *Water Use in the World*, on-line document.
10. World Bank (1992) *Water Supply and Sanitation Projects: The Bank Experience 1967-87*.
11. WRI, op. cit., p. 62.
12. UNDP (1997) *Energy as an Instrument for Socio-Economic Development*, on-line document.
13. Habitat, op. cit., p. 270; WRI, op. cit., p. 70.
14. WRI, op. cit., p. 20.
15. International City/County Management Association (ICMA) (1999) *Brownfields Issue Intersection*, on-line document.
16. UNEP, op. cit., p. 32.
17. European Commission (1998) *The Urban Environment in Development Cooperation*.
18. Ibid.
19. Habitat, op. cit., p. 410.
20. WRI, 1996.
21. UNDP (1998) *Human Development Report*, p. 105.
22. European Commission, op. cit.

Photo credit, pages 6-7: Mathare Youth Sports Association, Shootback Project, 1999, supported by the Ford Foundation and UNEP. The book from which this photo was taken, Shootback, *is a collection of photographs by youth from the Nairobi slums of their environment and daily lives. It is available from Amazon.com (http://www.amazon.com or http://www.amazon.co.uk).* ◆

Habitat's experience in Local Agenda 21 worldwide over the last ten years: approaches and lessons learned

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Abstract

This article reviews the experience of the UN Centre for Human Settlements in promoting Local Agenda 21 processes. Drawing on the experience of the principal Habitat programmes promoting Local Agenda 21 initiatives, namely the Sustainable Cities Programme (SCP) and the Localizing Agenda 21 Programme, it explains the different phases that form a common framework for participatory urban planning and management. The article also develops important lessons learned in 40 cities worldwide.

Résumé

L'article fait le point sur l'expérience acquise par le Centre des Nations Unies pour les établissements humains (Habitat) pour promouvoir l'application du programme Action 21 à l'échelon local. Sur la base des résultats des principaux programmes d'Habitat pour promouvoir ces initiatives, à savoir "Villes durables" et "Adoption d'Action 21 à l'échelon local", on explique les différentes phases qui permettent de bâtir un cadre commun pour un urbanisme et une gestion participatifs. L'article présente également les grandes leçons tirées de cette expérience dans 40 villes du monde.

Resumen

El presente artículo estudia las experiencias del Centro de las Naciones Unidas para los Asentamientos Humanos, respecto a la promoción de las actividades de la Agenda Local 21. Basándose en la experiencia de los principales programas de Habitat, consagrados a promover las iniciativas de la Agenda Local 21 (entre las que se encuentra el Programa de ciudades sostenibles -SCP- y el Programa de localización de la Agenda 21), explica las distintas fases que componen las infraestructuras comunes de la planificación y la gestión urbana centradas en la participación. El texto contiene asimismo lecciones importantes que han aprendido 40 ciudades de todo el mundo.

Agenda 21, the Programme of Action agreed to by 179 states at the Earth Summit (UNCED)[1] in Rio in 1992, reflects a global consensus towards integrated policy-making concerning environment and development. In Chapter 28 of Agenda 21, local authorities in each country are called upon to undertake consultative processes with their populations in order to achieve a consensus on a *Local Agenda 21* for and with their communities. Key partners in Local Agenda 21 processes include different layers of government, as well as civic society and the private sector, with the local authority in the driving seat. In the *Habitat Agenda*[2] the Local Agenda 21 framework has been reconfirmed as a valuable approach to harmonize urban development and the environment.

Eight years after the Earth Summit, it is clear that much progress has been made through initiatives by municipalities. Indeed, local authorities are a strategic entry point for initiatives aimed at resolving conflicts between urban development and the natural environment, and their participation is a primary determining factor in fulfilling Agenda 21 activities at the local level. Since 1992, over 2000 local authorities in more than 70 countries have started Local Agenda 21 campaigns.[3] The majority are in the industrialized world, with concentrations in a dozen countries. Local Agenda 21 has become a worldwide movement, and an impressive amount of experience in specific strategies, working methods, support systems, intensity of activity, speed of progress and level of results has been gained.

Urban environment activities supported by UNCHS (Habitat)

We will now focus on the principal Habitat programmes promoting Local Agenda 21 initiatives, namely the *Sustainable Cities Programme (SCP)* and the *Localizing Agenda 21 Programme (LA21)*, which constitute Habitat's Urban Environment Unit.

The Sustainable Cities Programme is a joint UNEP/UNCHS programme for the development of a sustainable urban environment, founded on broad-based and meaningful public participation. This programme was established in the early 1990s. Today, the programme is active in more than 40 cities around the world. Activities concentrate on building capacities in urban planning and management at the local, national and regional levels. City partners follow a carefully designed step-by-step process. This process utilizes city Environmental Profiles, City Consultations, and Working Groups to address priority environmental issues in a participatory way. The SCP experiences described in this paper are drawn largely from a recent evaluation of six African SCP cities.

UNCHS (Habitat)'s Localizing Agenda 21 Programme (LA21) offers a multi-year support system for selected medium-sized cities in Kenya, Morocco and Viet Nam to develop their Local Agenda 21s. These cities are typically provincial headquarters with between 50,000 and 500,000 inhabitants. Within this framework, LA21 supports the development and implementation of *broad-based environmental action plans* that focus on context-specific aspects of municipal planning and management. The programme enhances the capability of local authorities to integrate these action plans into a *strategic structure plan*, stimulate inter-sectoral synergy, draw attention to cross-cutting issues, and fulfil the local authority's pivotal role between all public and private local development actors.

The programme works together with partners at the local level towards a long-term shared vision on the desirable development and structure of the city. The focus is on daily action formulation and implementation, and on removing obstacles which hinder progress towards the above vision. Throughout the process, actors at every level are involved in the planning and decision-making process. Disputes are resolved between different levels of civic society.

Multi-disciplinary Local Teams based at the municipal council level serve as the focal point for information exchange, studies and projects concerned with local sustainable development. Advisory Boards represent a wider group of stakeholders involved in or affected by the project's action plans. An increasing number of local, national and international actors are re-orienting

Habitat activities in localizing Agenda 21

and integrating their activities into these Local Agenda 21 processes. Core funding for the Localizing Agenda 21 Programme is provided by the Belgian Administration for International Co-operation and supported by a consortium of Belgian universities, municipalities and NGOs providing support to programme activities.

A common process

An analysis of the SCP and LA21 approaches reveals a common four-phase process. These phases are:

1. Preparatory;
2. The City Consultation;
3. Strategy Formulation and Implementation;
4. Follow-up and Consolidation.

What follows is an overview of items relevant to SCP/LA21 for each phase, integrating examples from the programme cities.

Preparatory phase

During the preparatory stage of UNCHS activities in localizing Agenda 21, key partners are identified, a common understanding is developed, and the process itself is planned and designed. A situation analysis is performed which serves the purpose of identifying stakeholders, collecting information, and exploring problems and potentials. It is expected that the outcome of this phase will yield a framework agreement with partners, baseline information, and consensus on the key issues to be addressed.

In an SCP city, the situation analysis takes the form of an "Environmental Profile" which facilitates the identification of priority issues. Key stakeholders from the different sectors – private, public and community – are involved through a consultative process in the preparation of the profile and in identifying the priority issues facing the city. The Environmental Profile has two purposes: it provides baseline data and information on activity sectors, the environment setting and management arrangements; and it highlights the interactions prevailing between development and the environment and between the different activity sectors – interactions which are triggered through the competing uses of natural resources or which manifest themselves via the primary and secondary effects of environmental hazards resulting from sectoral activities.

In the case of LA21 projects, the Communication track of the programme comes into play, ensuring that good quality information on urban development is available. The programme focuses on ensuring that existing information flows within the local authority are efficient and unimpeded. It tries to ensure that information from different sectors is quickly and easily available to managers and decision-makers.

The City Consultation

Both SCP and LA21 projects follow the preparatory phase of activities at city level with a City Consultation. Here, stakeholders from all levels of government and relevant sectors come together to deliberate and agree on the priority issues confronting their city. Outcomes from this phase are expected to include formal political commitment, strategy outlines, modalities for the way forward, and a clear agreement on the next steps to be taken.

A City Consultation, in the SCP context, aims to identify, review and expand upon urban environmental issues of priority concern which affect the sustainable growth and development of the city. It brings together key actors from the public, private and popular sectors in order that they may commit themselves to agree and jointly develop an improved city management process. The City Consultation also serves the purpose of actually demonstrating the process of defining concerns at different levels, key actors, and the methodology for a cross-sectoral working approach. Lastly, the City Consultation agrees on an appropriate institutional structure integrated with and linked to existing structures. This demonstrates what resources are already available, and how they can be brought together to address the issues.

In many cities, the City Consultation has been acknowledged as a unique event which for the first time brings together a large and diverse group of people, provides broader exposure and awareness, and inspires a new sharing of responsibilities and pulling together of resources to resolve issues of common concern.

The commitments made during the City Consultation are, in the case of LA21, formalized through "*Urban Pacts*", which are dynamic, result-oriented negotiated agreements between all responsible parties integrated into the institutional framework of the local authority. These Pacts form a guideline for monitoring the progress of the implementation of Local Agenda 21 activities in the city. In the case of SCP City Consultations are followed by a City Declaration in which the stakeholders commit themselves to participate fully in the project.

Strategy Formulation and Implementation

The phase which follows the City Consultation is key to the localizing Agenda 21 process. It is during this stage that strategies for action are devel-

oped, demonstration projects are implemented, and a review is undertaken. After the City Consultation phase, negotiations on issue-specific strategies resume through Working Groups which include stakeholders in the respective issues. The most active individuals who have shown interest in the discussion groups during the City Consultation will naturally form the core of the Working Groups. Acting as cross-sectoral platforms for negotiation, Working Groups bring on board the relevant stakeholders affected by the issue. They possess the required authority, expertise and information, and therefore have the competence and capacity to contribute to addressing the issues. Working Groups are the primary vehicle of the process, and make cross-sectoral participatory planning and decision-making possible.

Follow-up and Consolidation

During the fourth phase of activities, both SCP and LA21 concentrate on monitoring and evaluating the process so far. In the case of the SCP, this phase also sees a significant emphasis on up-scaling and replication. Here the intention is to follow up on the results of demonstration projects and on the implementation of up-scaling and replication strategies. For both programmes, throughout all activities and phases, building the process into a routine "way of doing business" continues to engage cities long after the demonstration projects have been completed. Although localizing Agenda 21 activities are described in a logical sequence of phases and stages, as if one fed into the other, in reality they rather represent a complex, multi-track process.

Lessons learned

Information sharing is a prerequisite for participatory decision-making

The availability of good quality baseline information on various aspects of urban development is essential to start a Local Agenda 21 process. The environmental profile offers a good framework for compiling such an information baseline. In this regard, it is important to streamline existing information management practices within the local authority. Too often there is a lack of communication between municipal departments and state companies, as in Vinh City, Viet Nam, while information is used as a power tool within the organization, or between different public institutions. Information on issues such as industrial or residential investments, land subdivisions, infrastructure development and related budgets is often hidden within one department of the local authority. Ensuring that information on different sectors is routinely available to the top management is a prerequisite for a more integrated way of planning and managing urban development initiatives. Such an internal free flow of information is also essential for a credible strategy of involving external partners in environmental planning and management.

City Consultations contribute to city-wide ownership and lead to firm commitments

The City Consultation raises awareness of key environmental issues, mobilizes stakeholders, builds popular and political support, and provides the foundations on which the project proceeds. It should be noted that the extent to which civic society and private sector representatives can be involved in strategy development and priority setting during the City Consultation depends to a great extent on the existing planning traditions, institutional set-up and cultural context. It is very important to have baseline indicators for each city on the participation of stakeholders in planning, against which progress in broad-based consultation can be measured. City Consultations tend to generate long lists of actions which need to be prioritized. Criteria for prioritization include, among others, urgency, strategic value, political feasibility, impact on poverty, economic viability, and neighbourhood versus city-wide impact. The LA21 programme has shown that "Urban Pacts" are a useful instrument to keep direction and avoid deviation from the initially agreed list of priorities. When political, economic and environmental conditions change, these Pacts should be renewed and updated to reflect new conditions, while keeping in mind a long-term vision of the city's development. In the original SCP project design, there is only one City Consultation, after which the other activities follow in a linear fashion. It is usually appropriate to stage a second full-scale City Consultation, perhaps two or three years after the first one. This provides an important opportunity to revitalize broader community interest in the project, mobilize additional stakeholders, agree on additional priority issues, bring donors and potential funding sources into the process, and consolidate popular and political support.

The strategic value of demonstration projects

Experience indicates the potential usefulness of small-scale "demonstration" projects which can be swiftly implemented during the first few years of a Local Agenda 21 project. Properly done, such demonstration projects have three potential benefits. They can give visible evidence of "something happening" – which can be extremely valuable for generating community and political support. They can help test and refine methodologies, particularly the participatory, bottom-up approach as operated through the Working Groups. Lastly, they can give a welcome boost to the morale of those involved in the project and especially its Working Groups. In several of the SCP cities (Ibadan, Accra, and to some degree Dakar) the project staff and partners considered it a major handicap that they were unable to implement some strategic small-scale projects identified through the project process. In contrast, the ability in Dar-es-Salaam and Essaouira and, to a lesser degree Ismailia, to actually implement projects fairly early in the process was seen locally as an important factor in mobilizing popular and political support. For this reason, it has been suggested that Local Agenda 21 projects should have, as an integral part of their project design, a process (with activities and resources) through which the Working Groups can generate "fast-track" community-based demonstration projects, organizing their implementation in a participatory but expeditious way. When the process matures, demonstration project funds should be increasingly matched by local funds, as tying in local support for further interventions is likely to be more sustainable and replicable.

Investment projects: output or outcome of the Local Agenda 21 process?

In most cases, the SCP and LA21 programmes have been able to act as a catalyst to leverage investment funding. Apart from the municipal councils themselves, additional resources are coming from international organizations, bilateral development aid agencies, National Ministries, international and local NGOs, community based organizations and municipalities in the North. This leveraging of resources to implement action plans is made possible by virtue of the catalytic multiplier effect of the core funding, which enables local teams to formulate well-prepared action plans. However, several project documents placed too much emphasis on "bankable" projects as a key output. This has had a number of unfortunate consequences, the most important of which has been to mislead people into thinking of the project as a source of capital funding, either out of its own budget or through some special access to other external funding. It should be made quite clear that investment proposals are *outcomes* of the Local Agenda 21 process, *not outputs*. Moreover, it should be strongly emphasized that priority projects being developed through the Working Groups must be adopted by the relevant local government authorities, which should be encouraged to participate in their financing as a precondition for seeking external resources.

The need for flexibility in implementation and for systematic project monitoring

A Local Agenda 21 process should be considered as a general framework – not a straightjacket. For a capacity-building project emphasizing a Local Agenda 21 approach and dealing with a complex social-political environment, it is simply impossible to predict several years in advance how things will actually turn out. Allowing phases of implementation, geared to the natural progression of the SCP and LA21 processes described above, enhances this flexibility and offers opportunities to re-assess and re-direct particular projects on their best individual course. Alongside a flexible implementation pattern, it is essential to have an effective system of monitoring and assessment of progress in implementing Local Agenda 21 goals. The experience in the project cities has shown that the development of monitoring systems still leaves a lot to be desired. Attention is usually given to the establishment of Environmental Management Information Systems (EMIS) for the cities, but this is quite separate from the need for internal monitoring systems as an integral element of project management. Proper progress measurement systems should be developed at the start of the project, and it should be ensured that necessary baseline data are collected.

The importance of working in parallel on vision, action and communication

While implementing Local Agenda 21 processes, it is important to pay equal attention to vision building, implementing concrete actions and promoting communication between stakeholders. A good mix of these three ingredients is likely to yield a successful Local Agenda 21 process. However, prevailing planning and management practices in diverse institutional contexts show that there is often a lack of balance between these three components.[3] Vision without action does not produce immediate tangible results. Action without vision does not address strategic long-term conditions which ensure that essential resources for a qualitative urban life are available for future generations. Vision and action without communication are doomed to fail, as they do not take into consideration the aspirations of civic society as a whole. The different institutional, economic and political contexts of, for instance, Kenya, Morocco and Viet Nam result in Local Agenda 21 processes which tend to overemphasize or downplay one of these key components. Capacity-building efforts should be primarily geared to restore the balance between vision, action and communication.

The need to build capacity, particularly in medium-sized cities

Several cities engaged in Local Agenda 21 processes are faced with limited local human resource capacities for urban planning and management. This is particularly true for medium-sized cities. However, as urban environment problems in these cities are often in their early stages, much can still be accomplished in terms of prevention through choosing pathways of sustainable development. In addition, in medium-sized cities there are fewer external factors interfering with urban development as compared to larger cities. It is therefore easier to isolate causes and effects related to improved environmental planning and management and the quality of the living environment. Experience has shown that Local Agenda 21 processes in committed medium-sized cities are more likely to achieve sustainable impact than in larger cities. To this effect, the city leadership needs to be sensitized about the benefits to attract motivated and open-minded planning professionals, expose staff to innovative planning methods, and encourage them to enter into partnership with national government or university departments to fill certain capacity gaps. However, while encouraging such steps, one needs to continuously assess whether these measures can be sustained by the city's own resources.

Integration with local government and the influence of municipal politics

There is no standard specification, in the general Local Agenda 21 design, for the institutional location and relationships of the project. This is always a question which hinges on the specifics of the local situation. However, it is clear from experience that the project's physical and organizational relationships to the relevant local government are critical in determining whether the local government develops a sense of "ownership" and thus takes up, supports and sustains the project concepts and activities. The project design should therefore provide more guidance as to the underlying principles which might help avoid the difficulties which have been encountered. In some cases, such as at Nakuru, institutional changes are being implemented to structure the relationships between the local authority and other actors, including neighbourhood groups. Political change undoubtedly induces some delays in implementing activities, as in Morocco and Kenya, where local elections brought political change after two years in the project cycle. It should be recognized from the outset that the political factor is an integral part of formulating and implementing Local Agenda 21 processes at the municipal level. This factor can be handled in a constructive way by putting emphasis on familiarizing new elected officials with the long-term vision and actions already achieved under the previous Council, while at the same time leaving enough room for priorities of the new Council.

UNCHS activities in localizing Agenda 21 – a common framework

Phases	Stages
Phase 1: Preparatory Phase Outcome: *Framework agreement with partners, baseline information and consensus on key issues*	Start-up • Identifying key partners • Building common understanding • Planning and designing of the process
	Situation Analysis • Involving stakeholders • Collecting information • Exploring problems and potentials
Phase 2: City Consultation Outcome: *Formal political commitment, strategy outlines, modalities for the way forward and next steps*	City Consultation • Preparing • Conducting • Reporting
Phase 3: Strategy Formulation and Implementation Outcome: *Agreed strategy framework, demonstration projects, strategies for up-scaling and replication*	Developing Strategy Framework • Clarifying and evaluating options • Negotiating and formulating strategies
	Implementing Demonstration Projects • Identifying • Mobilizing partners • Designing • Initiating implementation
	Strategy Review City Consultation • Preparing • Conducting • Reporting
Phase 4: Follow-up and Consolidation Outcome: *Process and product monitoring and evaluation, feedback and adjustment*	Up-scaling and Replication • Follow-up on results of demo projects • Follow-up on implementation of up-scaling and replication strategies
	Monitoring and Evaluation • Institutionalization of the process • Institutionalization of achievements in specific areas

Getting the time-scale right: a Local Agenda 21 is bound to be a long haul process

Local Agenda 21 initiatives should be set up with a sensible time-frame from the outset. External initiatives can be catalytic to put Local Agenda 21 processes in place, but patience is needed to see results come through. In almost all contexts, the supporting programmes were faced with reactionary forces which threaten achievements and slow down the pace of implementation. Considerable time flexibility is needed to allow for local actors to fully back politically or socially sensitive components of action plans. Capacity-building initiatives of this nature, the purpose of which is to fundamentally change attitudes about and approaches to urban management, must necessarily take a long time and cannot be rushed.

Unfortunately, most of the projects begin with a wholly unrealistic two-year time-frame. Such a very short time-scale is often chosen not with any view to the dynamics and operational needs of the project process, but simply to fit the administrative requirements of a funding agency. A process

of five to six years seems to be more appropriate, with decreasing intensity of external inputs and with effective review procedures built in, so that progress is checked at key points in the overall process.

Developing and adapting tools and related training mechanisms

The development and use of tools is a prerequisite for efficient replication of Local Agenda 21 initiatives. Habitat has placed considerable emphasis on producing a series of process tools (such as consultation and strategy development), thematic tools (such as gender responsiveness, EMIS, air quality management) and leadership development tools (such as communication tools for elected leaders and conflict resolution tools). It is important to be very clear about the specific target group for which the tools are developed. For instance, the knowledge, skills and attitudes required to identify policy options for environmental technologies are very different depending on whether the target group consists of elected leaders, municipal technicians or external support agency staff.

There are advantages, in terms of consistency and economy of scale, to producing tools with a generic nature. However, it should be recognized that, when applying the tools, many efforts are required downstream to adapt them for use at the regional, national and local levels to reflect cultural, socio-economic and institutional diversity. These adaptations are often successfully developed by regional or national training institutions and provide valuable feedback in terms of lessons or experience and case studies. Tool development is thus a two-way learning process, iterating between methodological principles and their local applications.

Tailor-made replication strategies with key role for national organizations

In response to requests for replicating city experiences, different mechanisms have been deployed to further SCP and LA21 principles. These include links with ministries of local government authorities, associations of local government authorities and university departments. In some cases, new units are set up to spearhead the replication process. National replication strategies are continuously being refined, matching the needs

Local Agenda 21s: the cities of Ilo in Peru and Manizales in Colombia

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Introduction

Two small cities, Ilo in Peru and Manizales in Colombia, show the potential of Local Agenda 21s to help address urban environmental problems. This includes improving environmental conditions for city populations (e.g. improving provision of water, sanitation and solid waste collection) as well as reducing cities' ecological impacts on the region and, ultimately, moving towards more sustainable patterns of urban production and consumption. In other words, combining the "brown" agenda that focuses on local environmental health improvements with the "green" agenda that focuses on ecological sustainability.

In many ways, the two cities could not be more different. Ilo is a new city situated in a rocky desert area. It grew very rapidly from a fishing village to an industrial town due to the large copper mine and refinery that were developed there. Manizales is a long-established city, far inland, with a very mountainous topography and high rainfall and humidity. It was originally a coffee town and has little industry.

The only obvious points of comparison are that both are small cities and, in both cases, a Local Agenda 21 has been an important part of their development. Their Local Agenda 21s have taken very different forms, but each was developed by a democratically elected local government through a broad inclusive process that involved citizens groups, NGOs and, wherever possible, private enterprise. Both Local Agenda 21s have relied on considerable citizen action and involvement and have sought to coordinate the efforts of different government agencies and other actors.

The example of Ilo

In Ilo, the quality of the environment has been transformed over an 18-year period with major improvements in the quality of housing and provision of water, sanitation, garbage collection, electricity, paved streets and green areas. Ilo has a plentiful water supply, and virtually all waste water is treated in bio-stabilization ponds. Some 300 projects have been financed and implemented through partnerships between the municipal government and community-level management committees – with these also able to draw support from other institutions, including local NGOs. Projects have concentrated on different aspects of improving the immediate neighbourhood environment, such as paving streets, creating parks and installing piped water and electricity. The total value of investments is equivalent to more than US$ 10 million.

The municipal council has avoided the problem of squatting, despite a six-fold increase in population since 1961, by developing an urban expansion area where even low-income households can obtain a site on which to develop their own housing and receive basic infrastructure and services. A large coastal area, along the seafront within the city, has been reclaimed for public use with the municipal authorities helping to move the industries, settlements and institutions that had been located there. This has transformed three kilometres of the coastline, which now includes a pier, tree-lined walkways, play spaces and an amphitheatre. There has been a long fight with a copper factory generating high levels of solid waste and air pollution. Citizen pressure has forced the company to stop polluting the local bay and dumping wastes on local beaches, but reducing the very high sulphur dioxide output has proved more difficult.

Despite this limitation, municipal authorities, working with the citizens, have transformed Ilo from a place where migrants came only to work (and then return home) to a city where residents want to stay and invest. Development plans occur within a coherent environmental plan, arrived at through consultation with different local groups and supported by a Multi-Sectoral Commission on the Environment set up in 1987. There has been long-term political support for this whole approach, exemplified by the fact that six successive mayors have supported it.

The example of Manizales

In Manizales, a local environmental action plan (Bioplan-Manizales) was elaborated with widespread consultation. This action plan became integrated into the municipal development plan and municipal budget. It includes measures to protect and revitalize the city's rich architectural heritage, improve public transport (partly funded by a petrol tax), reduce the risk of

of the cities with the mandates, capacities and commitments of national partners. While peer learning is very valuable, experience has shown that decentralized dissemination has its limitations as the pilot city does not always have the necessary commitment, nor the appropriate capacity to transfer knowledge and skills to other cities. It is recommended that potential national replication agents need to be involved from the start in the city projects. As the power and revenue base of local authorities is often too weak to fully champion a Local Agenda 21 process, national governments have a critical role to play to create a climate in which a Local Agenda 21 can flourish. They can enable associations of local government authorities to take up their role. They can run nation-wide programmes for environmental awareness which can go a long way in complementing initiatives of individual cities. They can address environmental concerns which transcend municipal boundaries. They can organize national post-election training programmes for municipal elected officials. Above all, they can remove legal and administrative barriers that hinder effective implementation of municipal Local Agenda 21 initiatives.

Notes

1. United Nations Conference on Environment and Development (UNCED). The Earth Summit (1992) Agenda 21. The United Nations Programme of Action from Rio.
2. United Nations Centre for Human Settlements (Habitat). The Istanbul Declaration and the Habitat Agenda. United Nations Conference on Human Settlements (Habitat II), 1996.
3. ICLEI, *Local Agenda 21 Survey. A study of responses by local authorities and their national and international associations to Agenda 21*, 1997.
4. Tuts, R., Localizing Agenda 21 in small cities in Kenya, Morocco and Vietnam. In: *Environment and Urbanization*, Vol. 10, No. 2, October 1998.
5. The SCP Source Book Series, UNCHS/UNEP, 1999-2000, and the EPM Source Book Series, UNCHS/UNEP, 1997–2000 (e.g. *Integrating Gender Responsiveness in Environmental Planning and Management*).
6. *The Councillor as Guardian of the Environment* (part of the Training for Elected Leadership Training Materials Series), UNCHS, 1997. ◆

landslides (Manizales is in a mountainous region) and relocate the population living on steep slopes.

The relocation programme was linked to the development of eco-parks throughout the city, some on land whose slopes were too dangerous for permanent settlement and others with important ecological functions (e.g. one integrated into the city's watershed, and another focusing on biodiversity conservation). Some of the eco-parks are managed by community associations, which also manage two community plant nurseries and 15 neighbourhood parks.

Community based environmental initiatives helped generate jobs – for instance, managing eco-parks, running tree nurseries and increasing recycling. Community or neighbourhood based environmental action plans have also been developed. Such a plan for the Olivares commune (one of 11 communes in Manizales, and the one with the lowest average income) identified the main environmental problems, as well as environmental resources in the area on which their neighbourhood agenda could build.

Manizales has also developed an innovative indicators programme, the "environmental traffic lights", through which progress in each commune is tracked with regard to social conditions, community involvement, natural resource use, energy efficiency and waste management. Data on current conditions and trends in each commune are displayed in public places. For each indicator, public boards show whether things are improving (green), getting worse (red) or relatively stable (amber). Monitoring of progress is helped by environmental observatories set up in different parts of the city.

Relevance for other cities

Both these examples show the importance of locally defined and managed environmental planning that is rooted in democratic processes. As the text of Agenda 21 emphasizes, these Local Agenda 21s were developed through a broad, inclusive consultation process that sought to draw in all key interests ("stakeholders") and to develop among different (conflicting or competing) interests. Environmental planning moved from being something determined or driven by professionals, to something discussed and influenced by public consultation and implemented by public-community partnerships. These Local Agenda 21s also had to demonstrate their relevance to the livelihoods and living conditions of low-income groups: otherwise, they would have received little popular support. Ilo would not have received its US$ 10 million worth of investment if 300 citizen groups had not seen this initiative as relevant to their needs and made a considerable contribution.

If these are to be more than two isolated examples of innovation, they must also catalyze and support innovation elsewhere. In the case of Ilo, the Local Agenda 21 has catalyzed much interest. Politicians and municipal staff from other Peruvian cities have visited Ilo and taken advice from politicians and professionals who helped develop its Local Agenda 21. They have drawn on Ilo's experience in developing their own Local Agenda 21s, with the support of a Peruvian NGO, Ecociudad, and the Ilo based NGO, Labor. Other Peruvian cities (including Chimbote and Trujillo) also have innovative Local Agenda 21s, and Ecociudad has organized many workshops, seminars and exchange visits, so that all those involved within each locality learn from others' experiences.

The innovation in Manizales has received support from the Colombian government, which recognizes that it is helping pioneer a methodology that has relevance to other Colombian urban centres. It has received much support from the local campus of the National University, where the Institute of Environmental Studies (IDEA) helped develop, implement and monitor the Bioplan. IDEA has also developed training programmes for staff from other national, regional and local governments and NGOs involved in developing Local Agenda 21s.

Further information

On Manizales, see Luz Stella Velasquez , "Agenda 21: a form of joint environmental management in Manizales, Colombia," *Environment and Urbanization* Vol. 10, No. 2 (1998). More extensive documentation is available in Spanish from Luz Estela Velasquez, Faculdad de Architectura, IDEA: Universidad Nacional Manizales, El Cable, Manizales, Colombia (bioluz@emtelsa.multi.net.co).

On Ilo and innovations in other Peruvian municipalities, see Jose Luis López Follegatti, "Ilo: a city in transformation," *Environment and Urbanization*, Vol. 11, No. 2 (1999) and Liliana Miranda and Michaela Hordijk, "Let us build cities for life: the National Campaign of Local Agenda 21s in Peru," *Environment and Urbanization* Vol. 10, No. 2 (1998). More extensive documentation is available from Liliana Miranda, Foro Ciudades para la Vida, Ecociudad, Vargas Machuca 408, San Antonio, Miraflores, Lima 18, Peru (foro@ciudad.org.pe).

Achieving sustainable urban development: from brownfields to environmental management

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Abstract

Abandoned land or buildings whose redevelopment is hindered by real or perceived environmental problems are a common feature in cities that have undergone decentralization and economic decline, or changes in land use at the urban centre. Planning processes that integrate broader land use issues and the environmental remediation necessary for reusing these brownfield sites can encourage redevelopment in the context of efforts to reduce urban sprawl.

Résumé

Les terrains ou bâtiments abandonnés et dont le réaménagement est freiné par des problèmes d'environnement réels ou perçus sont monnaie courante dans les villes touchées par la décentralisation et le déclin économique ou par des modifications de l'utilisation des sols en centre ville. Les efforts entrepris pour réduire l'urbanisation sauvage, et plus spécifiquement les stratégies qui intègrent de façon plus large les questions d'utilisation des sols et d'assainissement des sites peuvent encourager le réaménagement.

Resumen

Las ciudades que han sufrido la descentralización y el declive económico, o en cuyo centro se han modificado las normas de urbanismo, se caracterizan por los terrenos baldíos y los edificios cuyo reacondicionamiento está condicionado por problemas ambientales reales o previsibles. Para fomentar su desarrollo evitando la expansión urbana descontrolada, es necesario elaborar planes para el aprovechamiento de los terrenos baldíos que observen todos los aspectos del uso del suelo urbano y respeten el medio ambiente.

The spatial shape and structure of cities is a theme of growing policy relevance. Rapid urban growth remains an issue in some OECD countries such as Turkey and Mexico, but for the most part member countries have shifted their concern to growth in the physical area covered by cities, rather than their population size. The phenomenon of population deconcentration, which has most often resulted from a mix of market and policy forces, has a range of unintended consequences. Among them are the abandonment of many industrial properties, as industrial and manufacturing activities decline or move to areas outside urban centres. Such properties are often referred to as "brownfields". For the purpose of work at the OECD, *brownfield sites are considered to be derelict land and buildings which are, or are likely to be, contaminated as a result of former industrial, commercial or governmental operations.*

More can be done to strengthen synergies between spatial and environmental policies, of which the redevelopment of brownfield sites is an important element. Overarching the process is the need for coherent policy integration at all levels of government to facilitate flexible and innovative strategies. Urban brownfields can be accommodated in city or metropolitan-wide strategies for economic development. Policy-makers shaping the future of regeneration initiatives to include brownfield sites try to adopt a cross-sectoral approach that clearly establishes relationships between economic, social and environmental factors. Brownfield redevelopment, and the reuse or conversion of existing building stock, maximize the potential of urban centres, relieving pressure for suburban development and new (increasingly costly) infrastructure.

OECD work: analysis and policy challenges

The OECD has considered the spatial context of brownfield sites since the mid 1990s, giving attention to the increasingly important role these sites have in realizing sustainable urban development. The growing number of brownfield sites is inextricably linked to the often dramatic and rapid shift from heavy industrial processes to service and knowledge based economies, with different technological needs and changing employment patterns. When old industrial activities become obsolete, the presence of derelict land has a negative impact on communities and investors alike, inhibiting cities' capacity to cope with economic transition. Physical degradation, contamination or the perceived risk of it, and lack of maintenance or modernization all compromise reuse and depress demand for these sites.

Failure to renew brownfield sites often affects the environmental quality of the surrounding area. When compounded with spatial patterns of social distress, the presence of brownfields helps explain why certain disadvantaged social categories are at much greater risk of exposure to contaminants. In the end, this can create a negative spiral of mutually reinforcing processes that eventually lowers the vitality of the city as a whole, as firms and people relocate to greenfield sites where the risks of contamination are minimal or non-existent and the costs lower. Brownfield sites have therefore become a persistent problem that cannot be alleviated by the normal process of modernizing cities' built environment.

Historically, environmental policy has provided the initiative to remediate urban land either known or suspected to be contaminated. Attention to the quality of land in cities increased when old industrial sites were identified as the site of pollution affecting adjacent properties (usually housing) and waterways. Most commonly, problems of such sites are associated with the presence in the soil of chemicals or products remaining from past industrial activities or from old building materials. Although the polluter-pays principle is commonly applied to contaminated land in cities, the pollution usually occurred in the past and was often caused by an agent, such as a firm, that no longer exists. The problem of contaminated land is therefore fundamentally different from that of polluted air or water – current best practice for waste treatment can only reduce the problem in the future, leaving the legacy of the past untouched. A remediation strategy is essential to address the environmental problems of contaminated land in cities.

Only recently has brownfield redevelopment been more closely linked to policies for urban regeneration. It has been increasingly intertwined with other issues concerning urban regeneration, especially redevelopment of all previously developed buildings and land whether or not these were ever contaminated. The challenge lies in improving the synergies between these two complementary strands. This holistic approach is consistent with efforts to promote sustainable development following the 1992 Rio and 1996 Istanbul summits, and with implementation of Agenda 21.

Conversion of existing urban areas and spaces to new uses must be addressed if efforts to control urban sprawl are to succeed. Many cities now contain areas where investment in housing, economic activities and amenities such as parks or recreational facilities could occur. These sites may or may not include buildings that can be renovated; they may

or may not include land that needs to be remediated. Because the costs and constraints related to renovation and remediation often compromise market opportunities for redevelopment, however, they are acknowledged to be a factor favouring greenfield development. The problems are specifically environmental or structural in nature (although both types of problems exist).

The redevelopment process encounters other obstacles, perhaps less visible but more difficult: planning systems, fiscal structures, inadequate public services (police, fire, education, etc.), lack of jobs, and social patterns and preferences. The precise mix will vary from country to country, and even from city to city. International comparative approaches draw attention to the fact that the problem is general, as well as local, and identify the mix of policies and mechanisms to combat a range of problems.

Linkages between environmental and urban regeneration policies

Cross-sectoral coordination through drafting of laws or implementation of policies is an increasingly common feature of brownfield regeneration strategy. In combination, these approaches can increase public funds available for remediation. They can provide a basis for partnerships with the private sector and local communities. The quality of specific projects is often the key to success, but efforts to set high standards for quality design and project management are often neglected. There is potential for good complementarity between environmental and regeneration policies: regeneration may advance more rapidly if brownfield sites are restored to useful life, and remediation efforts are strengthened if a coherent strategy exists to create or support economic and social uses for these sites.

Inevitably, this combination makes it more difficult to relate outcomes to different policy strands and associated expenditure. For example, to what extent is the addition of housing in an area with brownfield problems due to remediation of those sites, and what does it owe to the regeneration strategy for the area as a whole? The relationship between these two policy strands also involves the relative importance that should be given to brownfield remediation in any urban regeneration strategy, a question that raises the issue of whether governments should provide incentives or planning guidance to direct investment towards brownfield sites in preference to sites elsewhere, especially greenfield sites. Current policies do not yet resolve these issues.

Brownfield land for housing: an opportunity for redevelopment

The environmental advantages of brownfield remediation are clear: relieving pressure on rural areas and greenfield sites, reducing pollution costs, being more efficient with energy use and natural resource consumption, facilitating economic diversification, and addressing emerging habitat requirements.

With respect to housing provision, OECD's 1998 *Urban Brownfields* report found that:

"Brownfield land provides particularly positive opportunity for housing. Urban policy in some Member countries, Germany and the Netherlands being particularly important examples, has moved towards strengthening urban centres and developing cities that are more compact. From the case studies, it is clear that housing development has been an important aspect of redevelopment. Housing provided on contaminated land is highly contentious, and has required effective public communication and participation strategies to be effective. By no means have all the projects assessed attempted or succeeded in this arena, but where it has been a goal it has been effective, and where it did not happen the practitioners involved learned important lessons in overcoming the negative public perception associated with brownfield sites. In Canada, the Netherlands, Australia and the United Kingdom, brownfield sites are either already providing or are expected to provide both private and public sector housing. Prime city centres sites, however 'brown', will be developed, but encouraging the use of those in less profitable locations is a major problem".

Best practice and policy implementation

The following policy lessons remain pertinent and highlight the need for:

- Well-developed regional and city level strategies capable of addressing the economic and land use issues surrounding brownfield sites. Wallonia in Belgium, Nord Pas-de-Calais and Lorraine in France, the Ruhr in Germany and the Basque Autonomous Community in Spain provide examples of regional strategies for economic regeneration and brownfield redevelopment.
- Flexibility and innovation. Processes that are responsive and allow for change will encourage greater public and private sector investment levels, which is after all the key to achieving more brownfield redevelopment. The US Environmental Protection Agency's Brownfields Initiative has yielded over US$ 1.4 billion, leveraged through grants of US$ 58 million, and resulted in the creation of 3000 jobs. Experimental projects in Germany and the Netherlands have yielded similarly impressive results.
- Establishing appropriate funding mechanisms. Further private sector investment needs to be stimulated through a judicious mix of market based mechanisms. The role of the public sector as facilitator in terms of funding and initiative is significant. Future policy will need to consider the ongoing costs to the public purse, and how best to stimulate the private sector to take more responsibility for brownfield land.
- Partnerships. The development of proactive partnership approaches between public and private sectors and between levels of government, alongside the active involvement of civil society representatives, have been a central feature of successful redevelopment programmes. Public-private partnership initiatives in the Netherlands have facilitated successful brownfield redevelopment. The real benefits of partnership emerge when all actors are included in the process.
- Communicating the benefits of brownfield redevelopment. Reducing misconceptions and fears will enable greater flexibility in land use and, ultimately, greater economic freedom. Encouraging effective public participation will further integrate these sites into existing communities. Communicating and sharing experiences across international borders will facilitate "best practice" and allow OECD countries, for example, to address common issues with greater coherence and understanding. Involving communities who live alongside industrial and manufacturing sites (and are most directly affected by dereliction) begins at the environmental stage of clean-up, as exemplified by the Groundwork Trust in the United Kingdom and the Brownfields Initiative in the United States. It extends throughout the development process, as demonstrated during construction of new homes in the Black Country and Glasgow in the UK, and through the creation of employment opportunities at Emscher Park and Nordhorn in Germany.
- Assertive action and strong leadership at all levels of government. Compiling accurate, consistent and up-to-date information on the number, location and condition of contaminated sites within the national framework is crucial. A realistic understanding of the scale of the problem of brownfield sites is a vital first step in developing a coherent policy. The majority of OECD countries lack national level inventories. The Soil Protection Act in Germany and the National Land Use Database in the United Kingdom are examples of national level criteria established with the aim of realizing the redevelopment of more brownfield sites. Whether through specific environmental or land use legislation, the ultimate aim is relieving pressure on greenfield sites.
- More coherent national and sub-national legislative frameworks for urban, economic and environmental sustainability, including evaluation of processes and outcomes, is a crucial aspect of brownfield redevelopment. Indicators and benchmark criteria are essential.

The United Kingdom, the United States, the Netherlands and Germany remain important contributors within the international context. The UK has several decades of experience responding to considerable economic restructuring, which resulted in a massive decline of the industrial and manufacturing base and thus in many brownfield sites located in and around urban centres. The change of government in 1997 brought a new dynamism to urban regeneration. Although the impetus for the Urban Task Force was the need to provide 4.4 million new homes over the next two decades, there is an emerging consensus that consolidating urban areas as places where people live and work is necessary.

The United States has developed an outward-looking, multi-dimensional approach coordinated through the US EPA. Different departments and levels of government, the private sector, NGOs and community groups are participating in a nation-wide programme of pilot projects yielding profound economic, environmental and social benefits.

The Netherlands furnishes important lessons, having embedded the concept of the Compact City into its planning system. It supports innova-

tion and experimentation through pilot projects. Similarly, France, Sweden and Switzerland are pursuing strategies that consolidate urban centres through reuse of previously used land and buildings. Mexico and Turkey are beginning to address the consequences of rapid urbanization through planning systems. It is still too soon, however, to measure what is being done to set benchmarks. Resolving inhibiting issues of finance and land ownership will be imperative. Lessons from other OECD countries will facilitate sustainable responses to continued urban growth.

Several OECD countries are facilitating brownfield redevelopment primarily through existing legislative frameworks and policy guidance, the effectiveness of which becomes apparent when matched by stringent monitoring. The following country examples highlight how such changes are effected, and how countries facilitate sub-national efforts through strong national strategies.

The Netherlands

In the late 1970s, Dutch policy-makers started to work structurally with urban brownfield sites. The approach adopted has evolved considerably over the years. At present it is characterized by an integrated approach that incorporates diversity through the range of actors involved and their interests. This means efforts are made to produce coherent solutions drawn from various policy sectors and administrative levels. The Netherlands formally launched its urban approach with the 1985 Urban and Rural Regeneration Act, aimed at *urban renewal*, to bring about the physical improvement of the built environment. Formally, its purpose was to eliminate the quality deficits of the residential, working, production and living environments in the built-up area from before 1970.

During the 1990s, this policy was expanded into one of *urban regeneration*. Urban regeneration goes beyond simply modifying the housing stock and immediate surroundings. It also involves infrastructure, green spaces, economic activities and other neighbourhood facilities. Complementing the concept of urban renewal is *urban restructuring*, which seeks to achieve greater differentiation of the quality of housing and work where general well-being is under pressure. Spatial planning policy in recent years has been aimed at such development, whereby daily functional relationships in terms of living, working and care are able to operate at the level of the *urban region*. The strong national focus is enhanced through a coherent cross-sectoral approach. From the Dutch perspective, making towns compact has a positive effect on reducing transport needs, which in turn means fighting urban sprawl.

United States

The *Brownfields Initiative* has dispersed grants to hundreds of communities in the form of assessment pilots. These grants have leveraged over US$ 1 billion in public and private redevelopment and clean-up funds. Showcase Communities have also been designated to demonstrate the successful, systemic use of brownfields and community empowerment concepts to revitalize urban centres. Each project receives US$ 200,000 over two years to "test redevelopment models, direct special efforts toward removing regulatory barriers without sacrificing protection, and facilitate co-ordinated site assessment, environmental clean-up and redevelopment efforts at the federal, state and local levels." The Showcase Communities initiative, which supports the projects, has three main goals: promotion of *environmental protection, economic redevelopment* and *community revitalization*.

National policies affect local and regional planning through funding priorities. Local, regional and state governments establish the planning priorities of their communities and have planning agencies to implement these priorities. The extent of planning at the local level varies among states and communities. However, the Liveability Agenda, forwarded by the Clinton-Gore Administration, is seeking to provide incentives to communities to create stronger, more resident-friendly cities and towns. In an initiative designed to make US cities places where more people will want to live, work, and play, housing remains a significant national and local priority.

Germany

Germany has been particularly successful in developing sustainable urban policy that effectively addresses brownfields as part of an integrated strategy. Strengthening urban centres has been an important policy objective, to which land recycling has made an important contribution prioritized at both national and local level. Recent developments in both remediation and redevelopment initiatives and legislation reveal a more integrated cross-governmental approach than is evident in many countries. The federal government has adopted the objective of modernizing urban centres to strengthen the economic and social base and environmental quality of cities.

One of the aims of the 1998 Regional Planning Act is to strengthen city centre functions and structures. The Federal Building Code is being used to support these policy changes, as are transport initiatives and funding mechanisms. Within the Federal Building Code, provisions for sustainable urban development are made based on recognition that social integration, environmental improvement and economic development can be supported through providing a mix of uses and social diversity. Goals are set for the Länder, such as achieving a 10% increase in the number of small and medium-sized firms in inner cities and increases in housing provision on reclaimed sites. The federal government has secured the commitment of the Länder and Communes in favour of town and city centres required to achieve equality of opportunities compared with greenfield sites. DM 250 million of public funds was provided in 1998 to construct social housing in towns and cities. DM 9.2 billion was allocated for the period 1993-2000 to reduce town and city centre traffic.

Sweden

In Sweden, policies exist at the central and municipal levels of government to protect greenfield sites, although no national specific approach exists for reuse of brownfield sites for housing development. Over recent years, Stockholm has implemented a range of complementary policies that seek to reinforce existing urban areas, thus reducing pressure for development on the urban fringe. The strongest instruments, the City Plan and the Green Structure Policy, require that new dwellings, offices and other buildings be built on previously developed land rather than greenfield sites. The city has increased the density of population and jobs in its central, inner and outer areas. Redevelopment of previously used land is generally within a mixed-use framework, the co-dependence of work and home being encouraged in a pro-active, anti-sprawl context. Environmental standards are rigorously applied to all new development.

Public-private partnerships to provide housing are not yet evident in Stockholm. However, two issues for the future have been identified: affordable housing, and balancing the increased housing costs associated with measures to curb urban sprawl with the long-term environmental benefits that will be felt by the population as a whole.

France

Consolidating the urban centre of Paris has long been recognized as important. Reinforcing the city's residential character has been a priority over the past 20 years. During this time office floorspace has been strictly limited. Between 1993 and 1998, over 200,000 m² of office floorspace was reconverted to residential use, creating some 2400 new homes. Value Added Tax (VAT) on property conversions has recently been cut as a measure to reinforce existing policies. Ongoing public-private partnerships continue to facilitate such conversions, with the aim of reinforcing residential living in the city and ensuring affordability.

ZAC Rive Gauche is an example of a large-scale Paris urban project. Housing and planning are priority areas in the budget for the year 2000; some FF 3 billion will be dedicated to reconstructing the urban fabric and building social housing. The renovation will pursue a balanced mixed land use approach, respecting the original character and comprising historic preservation and new construction. As a result of a Convention signed between the national government and the city, 2100 new homes will be constructed on an annual basis.

Conclusion

OECD countries are responding to urban and territorial change through a variety of mechanisms. Brownfields are a major issue in some; in others they are an element considered by broader principles or systemic approaches such as environmental management systems. It is clear that there is no single universal option regarding implementation. However, there are common global challenges and aspirations that, when considered in an internationally comparative context, contribute to making a transferable tool kit that can be globally adapted to local territorial needs. For instance, there is sufficient evidence that redevelopment of brownfield sites can be realized either for housing, business or recreational use, or as a mono-functional option for a smaller site, or even as part

Looking ahead: new approaches for sustainable development

Achieving sustainable development requires that new approaches be developed at territorial level, i.e. that they be tailored by and to the local dimension. Hence, promoting instruments that favour organizations' self-management capacity has become a priority in the context of the increasing complexity of urban settings. Increasing complexity implies that different issues are managed at different scales. For example, public transport, waste collection and public health often cover different territories within an urban area. Among these innovative instruments is the environmental management system (EMS). An EMS is the "part of (an) overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy" (ISO 14001).

EMS implementation acts on an organization's management culture and may contribute to a number of policy objectives such as "reinventing government", "decentralization", "regulatory reform", etc.

EMS is a tool that enables organizations to collect the information necessary to measure and improve their environmental performance. It also allows for integration with traditional management tools (e.g. accounting, quality management, etc.). An increasing number of private and public sector organizations are adopting and implementing an EMS in one form or another. Many organizations even require independent certification of their EMSs. This is particularly important at a time when an increasing number of services are privatized. It also contributes to public management objectives. Environmental management systems are being adopted by businesses at site level (e.g. the EU's Eco-management and Auditing Scheme, or EMAS) and at the level of the entire organization (e.g. at Ford and BP-Amoco). They are being adopted in local administrations (e.g. municipalities, counties) and national ones (e.g. in Sweden by all major agencies, and in the United States through President Clinton's Executive Order).

According to a report to the OECD Council on improving governments' environmental performance, administrative agencies in Canada, Germany, Sweden, the United States and the United Kingdom are implementing EMSs, and even greater progress has been achieved at intermediary and local levels of government, particularly at county or municipal level. One OECD country has adopted legislation setting mandatory reporting requirements by the year 2006 for all territorial communities with a population over 100,000.

A 1997 OECD expert workshop that examined the practical effects, and trade implications, of adopting international EMS standards concluded that "international environmental management standards may help bridge more traditional command-and-control approaches with the flexibility and efficiency provided by a system approach to environmental performance... Once sufficient data has been gathered from various EMS pilot projects which can substantiate a linkage between certified EMS and superior environmental performance, authorities may wish to re-allocate some of their inspection and control efforts towards organizations that are not ISO or EMAS certified." This work also pointed out a number of conditions for capturing the expected benefits, and called for a more systematic link between macro-economic policies and local development conditions and actions.

From a strictly *environmental perspective*, an EMS offers the advantage of integrating information flows that affect several media. It also establishes the basis for identifying the sources of undesirable life-cycle effects, improves environmental cost allocation, and allows for evaluation of eco-efficient (and possibly resource-efficient) alternatives. By measuring the "just-in-time" financial implications of various options and technological paths, it can have ripple effects right across business clusters and trigger innovative practices along the supply chain, or downhill among clients. Governments in OECD countries have been looking at ways to favour EMS diffusion within governmental organizations and across businesses, especially among small and medium-sized enterprises.

Key components of an Environmental Management System
(adapted from Sweden's Environmental Advisory Council Report, 1997)

The Government's environmental policy for national authorities
Environmental review (e.g. environmental accounting)
Top management involvement
Environmental policy (how are we to work?)
Public servants and employees
Measures for improvement
Citizens and public opinion's environmental audit
Environmental objectives (what are we to achieve?)
Follow-up or environmental audit (how did it work?)
Action plan (what is to be done?)
Organisation and allocation of responsibilities and tasks

An *area-based approach* allows environmental policies to account for sectoral conflicts, and helps cities focus on local priorities. From a broader *territorial development perspective*, an EMS offers the advantage of providing a coherent framework within which information, often sensitive, can be exchanged between the private and public sectors. They support the preparation of an overall inclusive vision of the common future. For example, in Germany and Japan regional and local authorities have used EMS and related reporting mechanisms to negotiate attainment of environmental objectives with the private sector. Thus they can better take into account the economic and social implications of envisaged changes, together with their environmental aspects. As a transparent, role-based approach, EMS helps reduce competition among territories with widely differing environmental standards while enhancing competitive advantage. EMS diffusion can give central governments confidence that local authorities are able to make progress towards national objectives.

Accordingly, the OECD's Territorial Development Policy Committee has initiated a programme of work to examine the relationship between innovative practices and policies leading to sustainable forms of economic and environmental development at local, urban, regional, state or national levels in order to enable OECD countries

- to acquire a better understanding of the issues raised by the development and diffusion of EMSs and their links to sustainable territorial development;
- to consolidate a multi-stakeholder process by being able to tap and/or support the most interesting initiatives, and trigger innovative territorial policy initiatives adapted to scale;
- to help identify areas that may require harmonized approaches at the technical level or at policy level (e.g. incentive structures for EMS adoption, protocols for data exchange, roles of stakeholders such as Chambers of Commerce and Industry).

DM and CP

of an integrated mixed-use strategy elsewhere.

A number of common principles emerge from these experiences concerning the delicate balance between the pressing need to adopt boldly innovative approaches and the political leeway necessary to bring about desirable change. By following such principles, all levels of government can pursue strategies for identifying brownfield sites and establishing the appropriate potential future use. They may also develop priorities for action and, above all, create a flexible legislative and policy context – encompassing land use, economics and social dimensions to promote sustainable development.

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Using planning to enhance the urban environment

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Abstract

Urban planning in both industrialized and developing countries is becoming more integrative, tying together environmental functions of various elements of urban life such as economic development, transportation, recreation and energy consumption. Multiple-objective urban management aims to maximize the convergence of positive outcomes relating to enhancement of environmental quality, social equity and economic prosperity in every public endeavour. Achieving one objective in a narrow policy area while ignoring decisions' other impacts is no longer acceptable as good planning, if it ever was.

Résumé

Dans les pays industrialisés comme dans les pays en développement, l'urbanisme évolue vers une intégration croissante des aspects environnementaux de diverses composantes de la vie urbaine, telles que le développement économique, les transports, les loisirs et la consommation d'énergie. Le but de l'aménagement urbain à objectifs multiples est de maximiser, pour chaque projet d'aménagement public, la convergence de résultats positifs en termes de qualité de l'environnement, d'équité sociale et de prospérité économique. Atteindre un objectif unique dans un domaine d'action étroit, en négligeant les autres impacts d'une décision, n'est plus considéré comme un exemple de bonne gestion urbaine, s'il le fut jamais.

Resumen

La planificación urbana tanto de los países en desarrollo como de los desarrollados es cada vez más integradora. Conjuga las funciones ambientales de múltiples elementos de la vida urbana, como el desarrollo económico, el transporte, la diversión y el consumo de energía. La gestión urbana basada en la pluralidad de objetivos aspira a maximizar la convergencia de resultados positivos en cuanto concierne a la mejora de la calidad ambiental, la igualdad social y la prosperidad económica en todo empeño público. Alcanzar un objetivo en el marco de una política destinada a un tema limitado, haciendo caso omiso de sus repercusiones, ya no se considera una planificación aceptable, si alguna vez lo fue.

In the earlier part of the 20th century, environmental protection was most often associated in the public mind with the conservation of natural resources such as forests and rural landscapes. While public health movements certainly focused on sanitizing parts of the urban setting, environmentalism as a movement was primarily focused on preserving natural resources outside the city. Only rarely was there major discussion of urban planning's role in enhancing the urban environment, except in the context of creating open space through development of public parks. In the United States, Frederick Law Olmsted came to be seen as one of the pioneers in this regard, with a career spanning much of the late 19th century in which he created such urban oases as New York's Central Park and similar spaces in many other cities in the US and Canada.

Today urban planning is increasingly seen as performing a vital function in enhancing urban environmental quality. Moreover, the nature of this understanding is gaining considerable depth and subtlety, not only among professional planners but also among citizens, and not only in industrialized countries but also in developing ones. Urban planning is acquiring a more integrative purpose in tying together the environmental functions of the various elements of urban life, such as economic development, transportation, recreation and energy consumption. In some cases, planners and city officials are learning to apply the concept of multiple-objective management to conserve resources and political capital in the achievement of environmental objectives. Multiple-objective management can be described simply as the implementation of plans that serve more than one purpose through a single activity, such as providing recreational space and enhancing wildlife habitat in a floodplain while preventing unwise hazard-prone development.

This resembles the central focus of the sustainable development concept, which has been to maximize the convergence of positive outcomes related to enhancing environmental quality, social equity and economic prosperity in every public endeavour. Achieving one objective in a narrow policy area while ignoring a decision's other impacts is no longer acceptable as good planning, if it ever was.

Urban quality of life

One of the most visible indications of planning to enhance the quality of urban life is the amount and quality of parks and open space in the city. There are various ways of measuring this objective, none of them definitive, but the essential issue is that city dwellers still want and deserve some connection to nature, however fragmented that may be. For most people a densely built urban area unrelieved by green space is at least mildly depressing. Psychological studies in recent years substantiate this intuitive observation (University of Illinois research). Thus, allocation of urban park space, including not only recreational space but forest preserves and other natural settings, is a vital part of the function of comprehensive planning for a city.

Certain features of the natural landscape are particularly appealing to most people. One is access to the waterfront, whether that frontage be on a river, lake, bay or the ocean. People love to gather in or near water, as has been shown for many years by overcrowded urban beaches and highly successful waterfront developments in modern cities, to say nothing of the world's long-standing love affair with, for example, the canals of Venice. The quality of the urban design that goes into developing such spaces is critical to their success in creating a more hospitable urban environment. In the case of beaches, of course, maintaining an adequate level of water quality just to make them usable and safe is an essential starting point. But people enjoy a host of other activities along the waterfront as well.

Chicago provides one of the most dramatic examples of successful waterfront conservation. Its almost unbroken 20-mile stretch of waterfront park, the legacy of a civic initiative almost a century ago, has resulted in one of the most popular civic amenities of any city in North America, including bicycle and running paths, beaches, marinas, an aquarium, a public fountain and the simple ability to congregate at the water's edge and relax.

But Chicago, though unique in the extent of its preservation of a major lakefront, is hardly alone in developing waterfront amenities. Toronto is struggling to reclaim its waterfront on Lake Erie. Many other US cities are following Chicago's lead. In the 1970s, Portland established its Tom McCall Park along the Willamette River, memorializing an Oregon governor who fought hard for environmental causes. Chattanooga, Tennessee, described as the most severely polluted American city in 1968, has chosen to project a new civic image through sustainable development and is focusing much of its renovation on the Tennessee River, which cuts through the middle of the city. A new riverfront park celebrates this freshwater heritage, as does the city's new Tennessee Aquarium, which has become the state's leading tourist attraction. The aquarium, located downtown, is a primary source of environmental education for the community and is a visible symbol of the city's attempt to re-establish its link to the river.

Rivers have emerged as a magnet for linear parks, which generally consist of "greenways" that

follow river paths but allow development of hiking and bicycle paths in close proximity to the water, as well as the creation of picnic and other recreation areas. Boulder, Colorado, has developed a network of nearly 40 km of bicycle paths along Boulder Creek, notorious for flash floods due to its steep descent from the nearby Rocky Mountains. Because these are also often a means of diverting development away from vulnerable floodplains, they exemplify the principles of multiple-objective management: reducing losses from flooding, providing quality public recreation and protecting prime sources of wildlife habitat, wetlands, and riverine forests that serve to reduce soil erosion that clogs river channels and increases flooding. The feedback from each element of the multiple-objective equation therefore becomes positive instead of negative in terms of urban environmental quality.

The popularity of such planning is attested to by the growing number of cities now seeking to develop "Riverwalks," a term originally attached to a waterfront restoration project in San Antonio, Texas, but now generally used to describe virtually any linear riverfront park that incorporates paths for pedestrian use. Among other cities pursuing such projects are Pittsburgh, Cleveland, Toledo, Chicago, and Vancouver. Nearly every year, a new list of cities pursuing such projects emerges.

Urban climate

Parks and open space are only part of the process of creating a livable urban environment. Management of the urban climate has emerged as another major focus of planning efforts, along with the recognition that urban activities have significantly affected not only urban air quality but climate as well. Researchers have documented what has come to be known as the urban heat island (Figure 1), where the heat exhaust from urban buildings, transportation, and industrial activities has elevated the average temperature by up to 5°C. Combined with smog, as in metropolises like Los Angeles, Athens or Mexico City, the result has been an exasperating toxic stew within which people somehow live and breathe. This phenomenon is clearly worldwide, but there are ways of mitigating its effects even if it may not be possible to eliminate them completely.

For one thing, in recent years researchers have managed to quantify the impact of an urban forest in alleviating urban heat islands. Trees absorb much of the excess urban heat while also functioning as a pollution filter. An entire science has emerged concerning the use of urban forestry for this purpose, including extensive knowledge of exactly which tree species serve better for particular heat mitigation and pollution filtration purposes. These data, in turn, help planners make the case for acquisition of strategically located public open space because of the beneficial impacts. Some of the most important pioneering research in this area has been funded by the US Forest Service in its Urban Forest Climate Project (McPherson, et al.). These immediate impacts are in addition to other impacts of reforestation projects in combating global warming by acting as carbon sinks.

Since building design also affects urban climate through both radiation of sunlight and release of excess heat, as well as by affecting overall energy demand through consumption for heating and cooling purposes, regulation of building design through land use controls plays a crucial role in affecting urban climate, whether or not local planners are fully conscious of that role. To raise awareness, the US Environmental Protection Agency has developed its Urban Heat Reduction Initiative to spur innovation by municipal governments in addressing these issues. Among those innovations is a plan by the city of Chicago to develop a rooftop garden on its city hall. Black or dark rooftops absorb sunlight and add to building energy loads for air conditioning, while a garden converts sunlight for an environmentally valuable purpose. The primary architectural consideration is to ensure that the building roof is structurally capable of supporting the added weight of such an activity. In the same vein, Portland is undertaking development of thatched rooftops as a means of conserving energy.

Figure 1
Trees make a big difference in ambient temperatures: areas with little vegetation become "heat islands"

Managing natural hazards

Awareness is also growing of the need to use urban planning to reduce loss of life and property from natural disasters, particularly as populations in some countries including the US have become increasingly concentrated in hazard-prone areas. These include the Caribbean and the US Atlantic and Gulf coasts (hurricanes), southern Asia (cyclones and flooding) and the Pacific Rim (earthquakes, volcanoes and tsunamis). Because the US is subject to virtually all these hazards to varying degrees, hazard mitigation has become an important national policy objective. The Federal Emergency Management Agency (FEMA) has collaborated over the last several years with the American Planning Association to develop path-breaking guidance in this area. In a report on *Planning for Post-Disaster Recovery and Reconstruction*, detailed prescriptions are provided for avoiding or replacing unwise development in areas subject to natural hazards.

In many less developed countries, a major obstacle to the inclusion of such considerations in urban planning is lack of a national infrastructure of essential expertise to manage and direct programmes to steer development away from the most hazard-prone areas. As a result, death tolls from disasters are far higher in these countries than is typically the case in countries with a response, recovery and mitigation system as elaborate as that of FEMA. Even in the US, however, while the death toll remains low, the increasing movement of large populations into the most hazard-prone cities, in states like Florida and California, has dramatically increased the volume of real property at risk, resulting in higher costs from events like hurricanes and earthquakes. As a result, both of those states, for example, have steadily tightened many of their land use regulations to achieve better hazard mitigation.

Recycling land and materials

Recycling and reuse of raw and processed materials has been a central theme of environmentalism since Earth Day in 1970. Industrial processes have been retooled to turn former wastes into feedstocks, and municipal recycling programmes, many of which did not exist a generation ago, have been launched and expanded. Growing consumer demand for recycled content in paper, plastics and other goods has helped fuel the economic viability of many of these projects. The private sector has initiated many recycling schemes, but municipal governments have played a prominent role as well.

However, the concept of recycling has expanded beyond simply reuse of consumer goods and industrial materials. Cities have learned that they need to find ways to recycle land as well, cleaning up contaminated urban industrial sites, including those once used for waste disposal, and restoring them to effective use for new development. For many older industrial cities that have suffered from pollution by industrial wastes, this is a significant environmental priority. US policy has centered on redevelopment of what have come to be known as "brownfields," defined as sites whose potential

development is stagnated by real or perceived contamination.

The issue of perceived contamination is important because of the uncertainty that often surrounds former industrial sites, as well as the cost of testing and remediation. Cities, state governments and the US EPA have all taken steps and developed policy to address the problem of removing such impediments to reuse of urban sites, in part because their urban location means that most of the essential infrastructure already exists, whereas "greenfield" sites at the metropolitan fringe generally require considerable new investment in roads, water lines, sewerage and other infrastructure to make industrial development possible.

This is a serious challenge for many older industrial cities. Well-informed policy initiatives are needed in order to subsidize clean-up in some cases, pursue potentially liable polluters in other cases, and find the appropriate potential redevelopers for whom a given property's location and development costs will work economically.

Nonetheless, some cities have undertaken truly bold initiatives. Pittsburgh, once known as the centre of the American steel industry, is working with developers to build new homes atop 200-foot slag mountains left over from steel production during the last century. This requires groundbreaking research to find types of vegetation that can effectively take root in these steep, barren slopes, for which the city has enlisted scientific support from Carnegie-Mellon University. And in the adjoining creek valley the city is expanding an existing city park to link it with a greenway to the Monongahela River.

Probably the most promising new laboratory for such redevelopment of contaminated sites, however, is in Eastern Europe. The combination of increased environmental awareness in these countries and the availability of technical assistance from the US and Western Europe suggest that room exists for a great deal of fruitful collaboration.

Circulation: linking the elements

Although the foregoing elements of city planning are all important in establishing the quality of the urban environment, the biggest test probably comes in the way people and goods circulate throughout the urban setting. How far people commute from their homes to their jobs is a major determinant of the amount of fuel used for transportation, and consequently of the resulting air pollution from fossil fuel combustion. Means of transportation are equally significant. Obviously, the higher the percentage of commuters using types of transport other than the automobile, the greater the likely reduction in fuel combustion. Cities with high mass transit usage, high bicycle ridership, or smaller average distances between homes and jobs will generally do a better job of improving urban air quality. The challenge lies in knowing how to make that happen.

Some schools of thought have emerged in the urban planning field to advance ideas in this regard. For instance, the neo-traditional school of urban planning argues strongly for tightly developed urban neighbourhoods where residents can easily walk to many retail destinations, and for more mixed-use neighbourhood developments where stores and people live in close proximity. One specific orientation of this logic is transit-oriented development, which seeks to increase residential and commercial density in the vicinity of mass transit stations, including such convenience factors as affordable day care for children. In the US, the Chicago-based Center for Neighborhood Technology and the Natural Resources Defense Council have pioneered the advocacy of what they call "location-efficient mortgages" whereby home buyers can tap for borrowing purposes the reduction in family expenses which results from choosing a transit-oriented location that would allow them to forego use of a car. For the most part, however, European and Japanese cities are far ahead of the US and Canada in cultivating large-scale reliance on urban mass transit.

Many cities, including those in the Netherlands but also North American cities like Boulder, Colorado, have placed a major emphasis on facilitating bicycle transportation through developing paths and bicycle lanes. All of this has the added benefit of affording bicyclists expanded opportunities for maintaining physical fitness.

In the end, the single greatest contributing factor in facilitating an effective balance between the location of housing and jobs in major cities may be the movement towards sustainable industrial development. Often industry has been segregated from residential uses as a means to avoid imposing the noxious impacts of industrial activity, such as noise, air and water pollution, vibrations and odours on nearby residential neighbours. But what if industry was so clean that nobody noticed such impacts? The goal of sustainable development, including efforts to create sustainable industrial parks in places like Kalenborg, Denmark, and US parks like those in Cape Charles, Virginia, and Londonderry, New Hampshire, is to turn every

The role of the International Environmental Technology Centre (IETC) in urban environmental and freshwater management

Background and context

The International Environmental Technology Centre (IETC) was established by UNEP and became operational in April 1994. It has offices at two locations in Japan: Osaka City, and Kusatsu City in the Shiga Prefecture.

As part of UNEP's Division of Technology, Industry and Economics (DTIE), the Centre's main function is to promote the application of environmentally sound technologies (ESTs) for urban environmental and freshwater resource management in developing countries and countries in transition. IETC pays specific attention to urban environmental problems such as wastewater, sewage, air pollution and integrated municipal waste management, and to the management of freshwater resources.

IETC's mandate is based on Agenda 21. Consequently, IETC pursues a results-oriented work plan that involves:

- improving access to information on ESTs;
- fostering technology cooperation, partnerships, adoption and use of ESTs; and
- capacity building.

Mission

IETC's mission focuses on urban environmental and freshwater management. The Centre integrates water and urban environmental issues by:

- raising awareness;
- information exchange;
- capacity building;
- demonstration projects.

IETC's activities focus on:

- supporting governments and others through the identification and resolution of environmental problems;
- assessing and evaluating new technologies for current application;
- promoting and demonstrating environmentally sound technologies in developing countries.

Past IETC activities include:

- a publication on Alternative Technologies for Freshwater Augmentation in West Asia and the development of an EST Database, maESTro;
- a Diagnostic Study for Lake Erhai and Xier River Basins, China, to Contribute to Investment Planning for Regional Sustainable Development;
- a workshop and manual on Planning and Management of Lakes and Reservoirs to Address Eutrophication;
- a Regional Workshop on Adopting, Applying and Operating ESTs for Industrial and Domestic Waste Water Treatment;
- the development of an Integrated Programme on Environmental Management System for Urban Management;
- a resource book on Sustainable Management of Waste Water and Storm Water.

IETC is currently carrying out activities in the following areas:

- Environmentally sound technologies for construction and urbanization;
- contaminated and derelict land in cities;
- trenchless technologies;
- energy and water efficiency in cities;
- GHG emissions, air quality management and urban transport in cities;

industrial by-product into usable feedstock for another industry, so that no waste actually leaves the site. When industry becomes clean enough, there is no effective environmental obstacle to placing industrial facilities within walking distance of clean, healthy housing for employees who work in such factories. In the long term, a serious transformation of industry in this regard could afford opportunities for massive reductions in urban commuting to and from employment centres.

Integrating macro and micro scales

One criticism of sustainable development theory in the past has been that too much of it has seemed ethereal and highly visionary but lacked a basis in practical planning activities. An examination of cities that have taken sustainable development seriously reveals that this need not be so. The key to success lies in taking the general principles of sustainable development and boring down into the details of municipal government to apply them to increasingly intricate aspects of every operation, raising questions about why what is done is done in the way it is done. The results of such probes can be surprising.

For instance, Chattanooga found that it was indeed possible to establish a viable fleet of buses powered by electric batteries even if it had to foster development of a manufacturing industry for such buses in Chattanooga itself. The city not only created its own fleet, but soon became an exporter of electric bus technology as it improved the duration and operation of this type of batteries. The diesel exhaust from buses that continues to plague other cities is a thing of the past in Chattanooga.

Cities can also pioneer in other ways. Curitiba, Brazil, not only has one of the most efficient, uniquely structured bus systems in the world, but also makes it affordable to the poor by giving *favela* residents the opportunity to earn free bus tokens in exchange for helping recycle the city's garbage – another creative example of multiple-objective management. Other cities have learned to set an example for sustainable architecture by building solar-powered public buildings. The roof-top garden on Chicago's city hall is a way to set a public example of mitigation of the urban heat island effect.

Just as important as creating such public showcases is the need to educate people about them. Municipal web sites have become one dramatically successful means of doing this. Even in cities where personal computer ownership is low, public libraries and educational institutions can make computer kiosks available to encourage citizen access to such information. The municipal web site for Santa Monica, California, is particularly extensive in its use of a broad set of indicators to monitor the city's progress towards sustainability in areas as diverse as transit ridership, water conservation and educational achievement. Such web sites, which often involve release of extensive planning data, make it clear that the path to sustainability definitely involves a great deal of transparency in governmental activities. Santa Monica's planning department plays a leading role in assembling these data, precisely because this is already a key role for planners in the development of urban comprehensive plans. Sustainable development cannot move forward in a vacuum of effective public information.

Conclusion

This has essentially been a qualitative review of the function of city planning with reference to environmental goals, and for a reason. The point is that modern sustainable urban planning is increasingly an act of orchestration. Planners gather and sift data that have become ever more refined with advances of computer technology, including sophisticated geographic information systems, and are increasingly able to pinpoint the environmental impacts or benefits of various urban development policies. If the political will accompanies these advances, urban planning can help to coordinate and rationalize the wide array of urban land use activities to achieve gains in urban environmental quality.

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- development of cities as sustainable ecosystems;
- environmental management systems for cities and local authorities;
- wastewater treatment systems;
- water reclamation and reuse;
- phytotechnology and ecosystem management

For more information about IETC and its activities related to Urban Environmental and Freshwater Resource Management please contact the International Environmental Technology Centre (IETC), 2-110 Ryokuchi koen, Tsurumi-ku, Osaka 538-0036, Japan. Tel: +81(6) 6915-4580; Fax: +81 (6) 6915-0304; ietc@unep.or.jp; http://www.unep.or.jp

What is maESTro?

maESTro is a database which contains information on a full range of environmental technologies, institutions and information sources including air and water pollution, environmental management, human settlements, recycling toxic substances, solid waste, wastewater, water augmentation and more for use in the fields of urban environmental and freshwater management. The information is regularly updated by IETC as well as EST contributors, individual users, organizations and institutions.

maESTro was first developed as an information tool to disseminate information on Environmentally Sound Technologies (ESTs) on floppy diskettes, CD-ROMs and in report (hard-copy) format free of charge. In March 1998, in response to maESTro users' request, IETC decided to further develop maESTro so that people could access it through the Internet.

The technology can be "hard", "soft", and may be nature-based or artificially created.

All information contained can be shared with other maESTro users. All maESTro users are welcome to enter their own data through the web, e-mail, and/or regular mail so that users can exchange information through this interactive database.

EST contributors

Since 1996, maESTro has been honoured to partner with numerous government ministries, including the Ministry of Environment in New Zealand, the Ministry of Nature & Environment in Mongolia, the Ministry of Environmental Protection in Lithuania, the Ministry of Environment and Forests in India, the Ministry of Housing, Municipality and Environment in Bahrain, the Ministry of Environment in Lebanon, the Ministry of Energy and Mines in Eritrea, and the Ministry of Environment of the Republic of Korea.

Other contributors to maESTro promoting the exchange of EST related information include: UNIDO in Austria, GEC (Global Environment Centre Foundation) in Japan, the EPA (Environmental Protection Agency) in the United States, OCETA (Ontario Centre for Environmental Technology Advancement) in Canada and others.

Tanzania's Sustainable Cities Programme

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Abstract

This article briefly describes the experience of the Tanzanian Sustainable Cities Programme. It examines the environmental impacts of urban activities and the ways compromises are made and consensus, collaborations and partnerships developed to promote environmentally sustainable urban development. The Environmental Planning and Management (EPM) process has been successfully initiated in Dar-es-Salaam and replicated in the country's nine municipalities.

Résumé

L'article décrit succinctement l'exemple du programme Villes durables de la Tanzanie. Il s'intéresse aux impacts des activités urbaines sur l'environnement, à la façon dont des compromis sont trouvés et des consensus, collaborations et partenariats instaurés pour promouvoir un développement urbain écologiquement viable. Le processus de planification et de gestion de l'environnement (EPM) mis en place avec succès à Dar es-Salaam a été repris dans les neuf municipalités du pays.

Resumen

Este artículo describe sinópticamente la experiencia del Programa de Ciudades Sostenibles de Tanzania. Examina las repercusiones medioambientales de la actividad urbana y el modo en que se ratifican compromisos y se elaboran consensos, colaboraciones y asociaciones, a fin de promover un desarrollo urbano sostenible para el entorno natural. El proceso de Planificación y gestión ambiental (EPM) ya se ha aplicado con éxito en Dar-es-Salaam y se ha reproducido en las nueve municipalidades del país.

Background

Most developing countries are now aware that the undesirable environmental implications of growth can be addressed, and reversed, if local communities are empowered to plan and manage their environment in a more coordinated way through stakeholder participation and resource-conscious planning and management. It is on this basis, and in support of the Local Agenda 21 and Habitat Agenda,[1] that the Government of Tanzania recognizes the need to pursue environmentally friendly development policies and strategies to help ensure sustainable human development.

An important challenge in Tanzania is balancing accelerated economic growth and social development with efficient management of the environment and sustainable use of natural resources. This means integrating environmental concerns and approaches into national development programmes, building on positive synergies between development and the environment.

It is also widely accepted that effective environmental management can only be achieved where environmental considerations are integrated into policy shaping and actions. This resulted in the formulation of the National Environmental Policy (1997), under the custodianship of the Environmental Department of the Vice President's Office. The National Environmental Policy's stated objective is "ensuring sustainability, security and equitable use of resources for meeting the basic needs of the present and future generations without degrading the environment or risking health or safety."[2]

Given the interconnectedness of environmental resources such as air, soil, water and forests, degradation of any one of them will have far-reaching effects on environmental integrity. Accordingly, environmental programmes may not always correspond to the responsibilities and functions of a single government department or ministry. The Tanzanian Sustainable Cities Programme was therefore established under the Ministry of Regional Administration and Local Government. SCP-Tanzania uses an Environmental Planning and Management (EPM) process that facilitates and enhances multi-sectoral planning and coordination. The EPM process allows stakeholders to discuss their problems collectively, negotiate strategies, and seek solutions to priority environmental issues of concern in urban areas.

Many urban problems in Tanzania result from rapid, poorly planned urbanization and land use planning that has failed to integrate environmental concerns. Poor and fragmented governance, including poor institutional planning capacity, poor delivery of managerial and operational services and lack of public awareness of environmental issues, has hampered effective environmental management. Poor stakeholder participation in planning and implementing urban environmental infrastructure and services provision has worsened the situation.

Origin of the Sustainable Cities Programme

The global Sustainable Cities Programme (SCP) was launched in 1990 as a follow-up to UNCHS-Habitat and the UNEP Environment Guidelines for Settlement Planning and Management. According to the UNCHS, the SCP framework represents one such approach that allows cities' priority environmental issues to be effectively planned and managed.[3]

The Sustainable Cities Programme in Tanzania started as a Sustainable Dar-es-Salaam project, basically initiated to respond to the challenges and constraints the city faced. Dar-es-Salaam is the country's largest urban centre, with an estimated population of 3 million. It is one of the fastest growing cities in Sub-Saharan Africa, attracting over 240,000 additional people each year. Its annual growth rate has been approximately 8%. This rapid growth has not followed a coordinated long-term strategic development plan. Consequently, there is a housing shortage as well as inadequate urban infrastructure and services and a deteriorating environment. Past planning efforts, such as the 1979 Master Plan, have not systematically addressed the environmental challenges of the fast-growing urban population.

These problems have resulted from lack of resources and insufficient infrastructure investment, as well as from the City Council's difficulties in effectively planning, coordinating and managing operation and growth. Concurrently, deteriorating environmental conditions in and around the rapidly expanding city have presented major obstacles to achieving sustainable economic growth and development. The detrimental effects of this deterioration have been felt in all major economic sectors: in the living conditions of the general public, and especially those of the urban poor.

The EPM process's participatory approach and, most importantly, capacity building by urban local authorities empower the municipal councils in their pivotal role as the interface between central government, the community at large, civil society and the private sector. Through this process, different stakeholders are brought together, including those affected by the problems, those who have created the problems, and those with the institutional responsibilities, tools, instruments and resources to manage the problems.

Table 1
Priority issues identified and discussed in city/municipality consultations

City/ municipality (date of consultation)	Urban environmental issues	Remarks, outcome
Dar es Salaam (August 1992)	• improving solid waste management • upgrading unserviced settlements • servicing city expansion • coordinating city centre renewal • managing surface waters and liquid waste • air quality management and urban transport • managing open spaces, recreational areas, green belt hazards and urban agriculture potential • managing the economy and integrating petty trading • managing coastal resources	• production of City Environmental Profile • GIS EMIS unit established • action plans formulated • Hanna Nassif upgrading project is started • community infrastructure project established • solid waste collection privatized • parking system introduced • draft SUDP prepared
Mwanza (July 1998)	• unplanned settlement • liquid and solid waste management • transport and transportation • urban agricultural and recreational areas • informal sector and petty trading • air pollution • quarrying and mining • poor and bad fishing practices	• production of Municipal Environmental Profile • tree nurseries established • roads improved and drainage facilities set up in unplanned settlements • biogas plant constructed in Butimba Prison
Iringa (November 1998)	• destruction of natural resources • unplanned and unserviced settlements • liquid and solid waste management • resources reallocation • supply of clean and safe water • poor road network • lack of environmental education • soil erosion and degradation • urban farming	• production of Municipal Environmental Profile • working groups formed • coordinators selected and trained • strategies and action plans being prepared
Moshi (January 1999)	• unguided urban growth • public health and sanitation • institutional deficiencies in urban management	• production of Municipal Environmental Profile • working groups formed • coordinators selected and trained • strategies and action plans being prepared
Mbeya (July 1999)	• management of water sources and water supply • institutional strengthening of the council • HIV/AIDS epidemic and its impact on development of the municipality • Managing city growth • Solid waste management • Growth of informal sector • Transport and transportation	• production of a Municipal Environmental Profile • working groups have been formed • coordinators selected and trained • strategies and action plans are being prepared.
Morogoro (August 1999)	• unplanned settlements • liquid and solid waste management • transport and transportation • urban agriculture • inadequate secondary schools • clean and safe water • open spaces, recreation areas and graveyard management • urban safety • informal sector petty trading • institutional conflict between politicians and technocrats • investments, revenue and finance	• production of Municipal Environmental Profile • working groups formed • coordinators selected and trained • strategies and action plans being prepared
Tabora (October 1999)	• transport and transportation • water supply • unplanned settlements • solid and liquid waste management • urban agriculture • natural resource degradation • poverty and unemployment • management of recreational and open space areas • resource mobilization	• production of Municipal Environmental Profile • working groups formed • coordinators selected and trained • strategies and action plans being prepared
Arusha (January 2000)	• land use/land shortage • solid waste management • unplanned settlements • water supply and liquid waste • urban agriculture • urban transportation • informal sector and poverty alleviation • urban safety and security • tourism promotion	• production of an Environmental Profile • working groups formed • coordinators selected • training of coordinators under way

The participatory, bottom-up and inclusive approach of the EPM process helps strengthen the process of democratization at the municipal level and enhance urban management, leading to more equitable distribution of resources and services.

At Dar-es-Salaam, 30 working groups were formed to address prioritized environmental issues. They applied the following EPM steps:

- clarifying the environmental issues to be addressed;
- involving those whose cooperation is required;
- setting priorities;
- negotiating issue-specific environmental management strategies;
- formulating an urban-wide environmental management strategy;
- agreeing on environmental action plans;
- initiating priority programmes and projects;
- monitoring and evaluating progress and making periodic adjustments;
- strengthening environmental planning and management capacity; and
- preparing the draft Strategic Urban Development Plan (SUDP) for the City of Dar-es-Salaam.

Replicating the EPM process in other urban centres

Encouraged by Dar-es-Salaam's achievements in building environmental planning and management capacities and processes, the Government of Tanzania was requested by the municipalities, and agreed, to replicate the experience in the country's nine municipalities. Hence the National Programme for Promoting Environmentally Sustainable Urban Development was launched in July 1997.

The following objectives have been agreed at the national level:

- facilitating the process of SCP integration into the Dar-es-Salaam City Commission (DCC) and the municipalities;
- replicating the EPM in the municipalities to strengthen planning and management by local authorities;
- assisting in the development of an Environmental and Management Information System (EMIS) in the city and municipal councils, for data storage and management;
- supporting formulation of a Strategic Urban Development Plan (SUDP) in the city and municipalities.

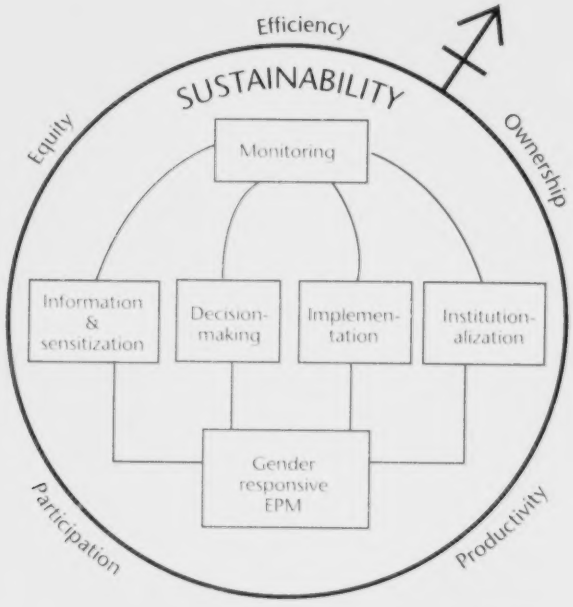
Other objectives include: training, communication and publicity; poverty eradication initiatives; and resource mobilization for project sustainability and creating gender awareness, through gender responsive environmental planning and management.

Table 1 highlights some of the priority issues identified and discussed by the City of Dar-es-Salaam and Tanzania's municipal councils.[4] It also indicates a number of the initiatives or projects that have been formulated. Capacity building is one of the most important concerns.

Gender responsiveness

Figure 1 represents a gender responsive EPM process with an overall goal of achieving efficiency, equity, productivity and, ultimately, sustainability through involving women and men at all levels in addressing urban environmental issues.

Figure 1
Gender responsive EPM process



Source: Gender Responsive EPM in Tanzania (1999)

Table 2
Access to and control over resources in Mwanza Municipality

	Access (%)		Control (%)	
	Women	Men	Women	Men
Land	80	81	33	64
Trees	59	57	27	66
Livestock	24	37	19	30
Income	66	66	28	71
Credits	40	38	22	39

Source: Gender Profile for Mwanza Municipality (1999)

SCP-Tanzania is currently helping municipal councils prepare gender profiles, so as to produce gender disaggregated baseline data as an important factor in facilitating gender responsive strategy formulation and decision-making. Much of the information presented in the gender profiles resembles that collected in the Mwanza Municipality (Table 2). As indicated in the table, only 33% of the 96 women interviewed had access to *and* controlled their land compared to their male counterparts, about 64% of whom had access to and controlled theirs. It is clear that gender disaggregated information is useful in developing policies, preparing strategic plans and, most importantly, making appropriate decisions.

Concluding remarks

Based on the outcome of the city/municipal consultations (which, practically, involve more than a reasonable number of participants from different sectors, NGOs, community-based organizations, communities and individuals representing the target groups), people seem to welcome the Environmental Planning and Management process approach and have agreed to adopt it. This is demonstrated by joint city/municipal declarations, signed by mayors and participants' representatives and witnessed by senior central government officials. The fact that the Sustainable Cities Programme has brought on board groups or stakeholders that are normally marginalized from traditional/formal planning and management, such as women, the private sector, NGOs and CBOs, is very positively viewed as responding to the Local Agenda 21 and Habitat Agenda.

The Environmental Planning and Management process should not be seen as an end in itself, however. It is a means to an end. The main driver of the Tanzanian Sustainable Cities Programme is sustainable urban development.

Notes

1. See *Our Common Future*, WCED, 1987, and Habitat Agenda, key commitments and strategies, UNCHS, 1996.
2. National Environmental Policy, United Republic of Tanzania, 1997.
3. See SCP Source Book Vol. II, UNCHS, 1999, p.127.
4. See Sustainable Cities Programme (SCP)-Tanzania, Newsletter No. 2, August 1999.

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Stockholm partners up

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Abstract

The new Stockholm Partnerships for Sustainable Cities forum will facilitate integration of sustainability into city planning through partnerships between cities and business. The forum, which begins in the fall of 2000, marks the 30th anniversary of the 1972 UN Conference on the Environment. Decision-makers from cities across Europe and their chosen counterparts in the business world will be invited to participate. Upcoming activities include workshops and online conferences on specific themes.

Résumé

Le nouveau forum de Stockholm consacré aux partenariats pour des villes durables devrait faciliter l'intégration du développement durable dans l'urbanisme grâce à des partenariats entre les villes et les entreprises. Ce forum, qui débutera à l'automne 2000, marquera le 30e anniversaire de la Conférence des Nations Unies sur l'Environnement. Des responsables municipaux de diverses villes d'Europe et des chefs d'entreprises européens seront invités à participer à cette manifestation. Plusieurs activités sont prévues, notamment des ateliers et des conférences en ligne sur des thèmes spécifiques.

Resumen

El nuevo foro de las Asociaciones de Estocolmo para las ciudades sostenibles facilitará la inclusión de la sostenibilidad en los planes de desarrollo urbano, a través de asociaciones entre ciudades y empresas. El foro, que comenzará en otoño de 2000, se incluye en la celebración del 30 aniversario de la Conferencia de las Naciones Unidas sobre el Medio Ambiente de 1972. Participarán los dirigentes de varias ciudades europeas, así como sus homólogos empresarios. Entre las actividades previstas se incluyen talleres y conferencias por ordenador sobre asuntos específicos.

The city of Stockholm will launch the Stockholm Partnerships for Sustainable Cities, an initiative to facilitate the integration of sustainability into city planning through partnerships with business, in the fall of 2000. Currently at the embryonic stage, Stockholm Partnerships is keen to garner input on this initiative from both public and private sector representatives that have prioritized sustainability in their operations. Their feedback will help shape the forum over the next two years.

The forum will invite decision-makers in cities across Europe and their chosen counterparts in the business sector to discuss themes that define their ambitions to the highest sustainability level. Workshops and online conferences will take place on a regular basis for the duration of the forum.

The Mayor of Stockholm, Carl Cederschiöld, was interviewed on how the city intends to commemorate the anniversary of the 1972 UN Conference on the Environment. "We want to mark what happened here in Stockholm almost 30 years ago by looking where the debate will be taking us in the years ahead," he began. "I continually hear of the far-reaching results that are being achieved when the public sector integrates the dynamics of the private sector – taking their role as suppliers one step further to become active stakeholders in the projects. I've seen it in my own backyard with Hammarby Sjöstad and in our efforts to improve the quality of water in the Stockholm area."

Cross-sectoral cooperation is an indicator that society is entering a new phase in the sustainability debate. In this changing scenario, no single sector holds the answer or sole responsibility. Through dialogue that goes past regulation and compliance, solutions are being defined and achieved. Cederschiöld believes sustainability issues have become more prominent in the objectives of both the private and public sectors. With this commonality, far-reaching results can be attained by integrating approaches from both sides.

A two-pronged approach

Stockholm Partnerships for Sustainable Cities was born out of this growing trend. The target group's common denominators are the holistic integration of sustainability in a project's core values, and urban development projects' use of dialogue with industry as an instrument of change. European local governments with these objectives are being identified. In turn, they invite their business partners to jointly take part in the Partnerships forum.

Defined target groups for Stockholm Partnerships are on the strategic level, reflecting the trend to bring these issues "into the board room" or encourage holistic integration of sustainability. The forum is based on a solutions-oriented, proactive exchange on experience and ongoing efforts, rather than theory.

Alf T. Samuelsson, the 1999 President of the Eurocities Environment Committee, is Stock-

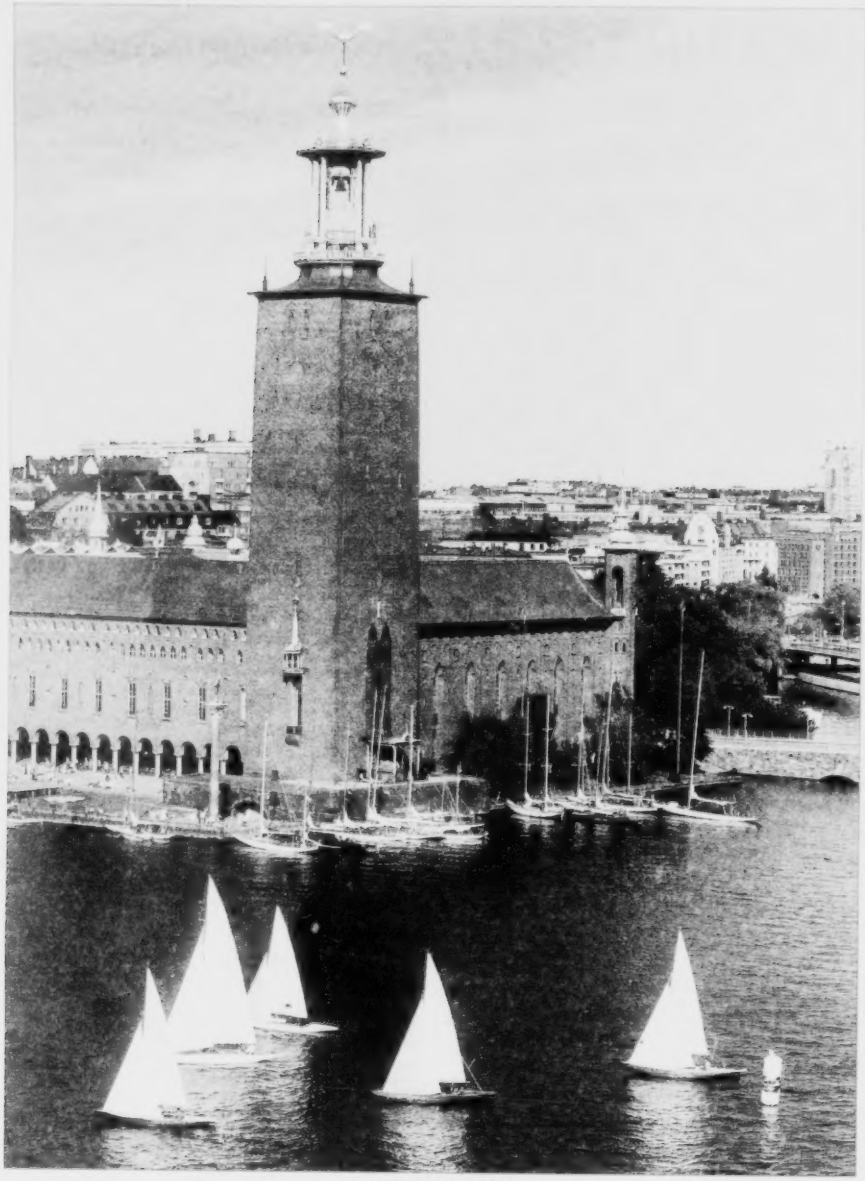
Breaking the waves

John Elkington, a well-known figure in sustainability circles, has characterized the new millennium as a shift to a third wave in the environmental debate. The first great wave of environmentalism peaked between 1969 and 1973, when concerned citizens influenced society both economically and politically. A milestone in this initial environmental wave on the global level was the 1972 UN Conference on the Human Environment in Stockholm, at which the dimensions of the environmental challenge were identified. It went on to spur the birth of a global citizens movement, as well as government response in countries around the world.

By the early 1990s, at the crest of Wave 2, we headed to another global environmental summit, this time in Rio de Janeiro. Government officials on all levels responded to the call, joined by corporate executives declaring themselves to be committed environmentalists. The new sustainable development concept was supported by politicians and proactive businessmen alike. At UNCED in Rio, industry became part of the solution. The role of the marketplace became an integral part of environmental policy.

Compressed time scales and complex commerce, more international than before and bringing about a greater need for dialogue across sector boundaries, characterize the third wave. If the energies of Wave 1 in the early 1970s were largely focused on public policy and regulation, and those of Wave 2 were identified through markets and technical solutions, Wave 3 will focus on changing cultures – corporate, economic and political.

See: John Elkington, The Next Wave, TOMORROW – Global Environment Business Magazine, *No. 6, 1999.*



Stockholm City Hall

holm's Vice Mayor and has environment and social integration under his wing. His aim was to set up a forum on sustainability and how it was being addressed from different perspectives. The environment debate no longer focuses exclusively on technical solutions, he explained. The issues have gone further, to encompass how to build vibrant commercial and living urban centres, increasing accountability, planning and defining the economics of sustainable change, and engaging the community in sustainability.

Pushing the envelope across Europe

UK government/industry partnerships have been successful in the social arena, as can be seen in the feedback from Norwich in the United Kingdom, winner of the 1999 European Sustainable Cities Award. Its approach was to focus on governance through partnerships with businesses, as well as other community members. Project formulation, priorities and funding are decided upon with greater influence, accountability and transparency of Norfolk stakeholders.

The Dutch, with their covenant approach, have been recognized for their efforts towards governance through partnerships. Scandinavian public/private cooperations are known for their work in eco-innovation. There are examples from Norway and Germany of how industry is pushing the sustainability envelope in urban planning in its role as tenants. Stockholm Partnerships will be inviting the local governments and their business partners behind these and other projects to delve into the dynamics of their working model as "partners" – to find out what works and why.

"In Stockholm Partnerships, forward thinkers in sustainability and urban planning will help the forum take what's going on in Europe's cities one step further. Hopefully it will provide insight for other urban projects with similarly sustainable ambitions," Samuelsson said in outlining the forum's purpose.

Close encounters

"In the initial phases of Stockholm Partnerships, we aim for representation from a small group of urban projects. We'd like about three projects from around Europe to initiate the forum in 2000. By 2002, that group will have grown to a maximum of 10 projects," Samuelsson explained.

Business partners can vary from users – or companies locating in the urban development project – to suppliers. Users are those companies that have been driving forces behind the sustainable planning of the project. They can include those locating there because of its profile. Tenants such as Daimler Benz, influential in Potsdamer Plats' environmental profile, and Telenor in Fornebu, Norway, are two examples of the types of "users" that have played a key role as partners.

Service providers for high tech telecommunications to construction solutions and transportation, and companies catering to residents' environmental interests, are included in the "supplier" category.

Business sense

One of the driving forces behind business's proactive positioning in regard to sustainability is society's shift from being regulations- to incentives-driven. Through this thinking, the public sector can capitalize on business's ability to adapt quickly to change and spur on a creative process of new innovations.

The forum consulted business representatives on the components to be integrated into Stockholm Partnerships. Per Westlund, Vice President of the construction company Skanska, contributed advice reflecting the predominent view of proactive industry. It is important for dialogue to go beyond the limits of compliance. Partnerships should be a forum on creating positive rules for the game, and there should be an open debate about achieving better solutions.

Practical examples

From a supplier perspective, the incentive for business to get involved in joint initiatives goes beyond winning government contracts through a sustainability strategy. It makes long-term business sense to enter into cooperation with local government.

Ericsson, the information and communications technologies corporation, is a case in point. Mats-Olof Hedblom, Ericsson's head of environment, spoke about the changing role of corporations in society when interviewed on his view of cross-sectoral cooperation. He believes proactive partnerships with stakeholders are prerogatives for companies in a competitive marketplace because they increase credibility. He also believes stakeholders want corporations to play a broader role in society. He emphasized the mutual advantages of partnerships, which can promote new technologies and applications to replace ineffective approaches – saving money and man-hours and creating high-tech jobs at the local level.

"WAP and wide band technologies are excellent examples of being sustainable and economically viable," says Hedblom. "With access to information on traffic situations 'as it happens', the num-

ber of cars on the road can be reduced. Through communicating about who is heading where, we're creating car sharing opportunities and vehicles in parking lots can be drastically reduced. All players win."

Sharing competence

Sustainability management through cooperation is the focal point of Stockholm Partnerships. Business and government have distinctive operating cultures. The current trend to achieve goals through partnerships requires an understanding of these differences in order to orchestrate one common goal.

Starting in the fall of 2002, the Stockholm Partnerships forum will act as an exchange where competency built up in participating cities is shared through workshops and the web site. The organization has been set up much like the WBCSD (World Business Council on Sustainable Development) model, which uses liaison delegates to represent their members at workshops and online conferences.

The organization is planning four workshop sessions during the one and a half year period, as well as regular online conferences centred on specific themes. Its aims are to study the mechanics of experience, covering the technical aspects of planning, construction and use, and to span the total life cycle of an urban development project. It will focus on practical examples rather than on theory or visionary thinking. Speakers at the strategic level from sustainability circles, urban planning experts and organizational management will spur on the debate.

"We are formulating the sessions to be in a relaxed atmosphere, where members can roll up their sleeves to have an open discussion of the possibilities of achieving goals through partnerships," explains Samuelsson. Through the Partnerships, participants will decide on the subject matter to be taken up. They will spotlight such topics as:

1. new partnership forms for engaging business expertise;
2. creating vibrant commercial urban centres;
3. marketing urban centres in a sustainable light;
4. key sustainable issues facing urban communities;
5. focus on the long term – overcoming the short term;
6. jointly engaging end-users and the community at large;
7. governance through partnerships;
8. furthering innovation;
9. bridging the gap of segregation.

An online newsletter and web site chat room will showcase best practice, common concerns and trends. Samuelsson's objective for Stockholm Partnerships is that it will become a platform for taking these discussions to all interested parties. His emphasis is on extending the knowledge acquired during the process outside the four walls of the forum.

Stockholm Partnerships Convention

In the final phase of Stockholm Partnerships, in the spring of 2002, the workshops from the previous year and a half will lay the foundation for a European-wide convention to be held in Stockholm. Here, best practice will be shared on a broad scale and the results of the Stockholm Partnerships model will be discussed with all interested stakeholders. Hosting the convention is also Stockholm's way to officially mark the first UN global gathering on environment issues 30 years ago.

Improving quality of life in urban communities is one of the most important issues facing any local government. It is a challenge that cannot be met by addressing these issues from one sector's perspective alone. Stakeholder engagement is the most effective way of looking around the corner to see what issues lie ahead. Ericsson's Mats-Olof Hedblom concluded: "Cities are home for many of the environmental challenges facing us. If industry and the public sector can't cooperate locally, how are we going to manage the global issues?"

Partnerships welcomes your input.

Astrid von Schmeling is a communications consultant to stakeholders pursuing a proactive stand on sustainability issues. She has been involved in the environment debate as partner and director of TOMORROW – Global Environment Business Magazine.

Hammarby Sjöstad: an example of Stockholm's sustainability approach

Stockholm is recognized for its approach to environmental issues. Receiving the 1997 European Sustainable Cities Award is an honour of which City Hall is proud. One example of Stockholm's sustainability approach is Hammarby Sjöstad, referred to as the largest ongoing construction site in northern Europe.

The environmental programme for Hammarby Sjöstad was put forward in 1996 to spearhead ecological and environmental living in the Stockholm area. The community will be home to approximately 15,000 apartment dwellers, as well as 300 businesses. Construction is scheduled to take place between 1998 and 2005. Housing is grouped in neighbourhood blocks with a mixture of apartments, shops, offices and small-scale industry.

The project is planned and constructed according to strict life cycle analysis (LCA) and eco-efficiency principles. The environmental impact of applied solutions will be 50% of those of the best technologies of present-day construction projects.

Working relationships between industry, research institutions, the state, local authorities and environment-oriented organizations are an ongoing process. The goal is to develop techniques that, in the long term, will also enhance Swedish export of environmental expertise.

"Our cooperation form is primarily concentrated with the construction companies – like JM and Skanska. They in turn work with suppliers such as Electrolux and Birka Energi, a local energy company. The size of Hammarby Sjöstad makes working with us intriguing for major corporations," says Kerstin Blix, Hammarby Sjöstad's environment manager. "Technical contracting is behind the introduction of new technologies. Individual measuring systems – an economic tool for residents to see firsthand their water, heating and gas usage – is one example. It is a way for consumers to make sure that what's used is reflected in the amounts billed. Then there is our method of ventilation, regulated by the number of people in a room at a particular time. These systems are yet to be applied anywhere else."

By employing modern information technology, quality of life will be improved through time-saving measures, increasing accessibility to – and transparency of – local decision-makers, and creating comfort as well as reducing costs for those living and working there.

Synergies of the LCA approach

Hammarby Sjöstad's environmental programme is regarded as unique primarily because it includes:

- a unique model for introducing cutting edge technologies in the water purification process and waste management systems;
- a model used for technology procurements;
- competition on environmental technologies;
- integration of LCA and environmental impact studies;
- contracting based on function;
- international cooperation with cities interested in applying the same concept.

Results of the programme

Three years into the project, the result of this strategy has been the implementation of new technologies in energy, transportation and IT solutions.

Goal-oriented planning, projection, construction and administration are required in order to achieve the goals for Hammarby Sjöstad. The active participation of all parties involved is needed: the city, landowners, builders, subcontractors, administrators and users. During the introductory phase of the planning process, the main responsibility will lie with city authorities and other landowners/leaseholders. As the process gets under way, responsibility will be transferred to the builders and contractors, after which time the primary responsibility will be with administrators and users.

Stockholm welcomes your input. Contact Alf Samuelsson, Vice Mayor, Stockholm City Hall, Tel: +46 (8) 508 29000; E-mail: partnerships@cityhall.stockholm.se; or Kerstin Blix, Environment Manager, Hammarby Sjöstad, Tel: +46 (8) 508 26275; E-mail: kerstin.blix@hammarbysjostad.stockholm.se.

Management and conservation of water resources in urban areas

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Abstract

To manage and conserve urban water resources, a wide range of approaches need to be available. Waste water treatment is expensive, and developing countries are often hindered in their use of two- to four-step treatment. Chemical precipitation, and a combination of waste stabilization ponds and constructed wetlands, can often reduce impacts on water resources considerably. It is recommended that developing countries consider using these methods.

Résumé

Pour gérer et préserver les ressources en eau des agglomérations, il est indispensable de disposer d'un éventail de stratégies aussi large que possible. L'épuration des eaux usées coûte cher et l'utilisation de systèmes de traitement en deux, trois ou quatre étapes pose souvent des problèmes aux pays en développement. La précipitation chimique et le recours simultané à des étangs de stabilisation et à des zones humides spécialement créées à cet effet permettent dans bien des cas de réduire considérablement les impacts sur les ressources en eau. Il est recommandé aux pays en développement d'envisager ce type de méthode.

Resumen

Para administrar y preservar los recursos acuíferos urbanos, es necesario contar con una gran variedad de métodos. El tratamiento de aguas residuales resulta costoso y los procesos de dos a cuatro fases constituyen un obstáculo para los países en desarrollo. Las precipitaciones químicas, junto con el uso combinado de pantanos y estanques para eliminar residuos, pueden contribuir considerablemente a reducir las repercusiones en los recursos hídricos. Se recomienda a los países en desarrollo el empleo de estos métodos.

Urbanization is increasing very rapidly in developing countries, resulting in an equally rapid growth of drinking water demand in urban areas. This problem may be formulated as follows: how can the rapidly growing urban demand for adequate drinking water quantity and quality be met? Environmental problems today are very complex. Not surprisingly, their solutions require a wide spectrum of solutions. Environmental management 30 years ago was dominated by end-of-pipe solutions, while today we do have a wide range of possibilities. Solving the problem described above requires working with several possible approaches at the same time.

Figure 1 illustrates the approaches or principles we can use to solve the environmental management problems associated with urban water resources. There are four possibilities, according to this diagram:

1. increase the input (e.g. collect more rain water);
2. increase recycling;
3. reduce consumption; or
4. reduce and prevent deterioration of water resources.

Each of these possibilities will be touched on below.

Recycling

To find a solution to the shortage of urban water resources, the first step is to set up a conceptual diagram of all urban water flows – in other words, to perform a system analysis of water consumption and available resources (see also Jørgensen, 2000a). The common solution, when water is abundant is illustrated in Figure 2. Water supply and waste water problems are considered independently.

Figure 3 shows a different approach, in which recycling is treated as a versatile and useful solution. Industrial waste water is reused by the industries. Treated municipal waste water is used in industries where high water quality is not an issue. Reuse of waste water for irrigation could also be considered.

In addition, recycling after treatment by industries may take place.

The waste water is also treated to facilitate production of high quality water on the basis of the receiving water, such as a river or lake. Figure 3 illustrates the concept of water recycling. The cycling of the entire hydrosphere takes in the order of 2000 years, while it is claimed that the Rhine is used 20 times or more between its source and the North Sea. In Pretoria and Windhoek (South Africa), multi-step waste water treatment plants produce drinking water with sufficient quality to be reused directly. Recycling between the two extremes, through multi-step waste water treatment and by nature, should always be considered when water resources are not abundant. It is obviously a matter of costs and water shortage.

Multi-step waste water treatment is very expensive, while recycling by nature is free of charge. The cost of the solution in Figure 3 lies between these two extremes, with a rather moderate cost for possible reuse of industrial waste water. The recycling solutions are not initiated by themselves. In most cases, they would require incentives such as strict legislation, high water costs, or a green tax on water consumption and waste water discharges.

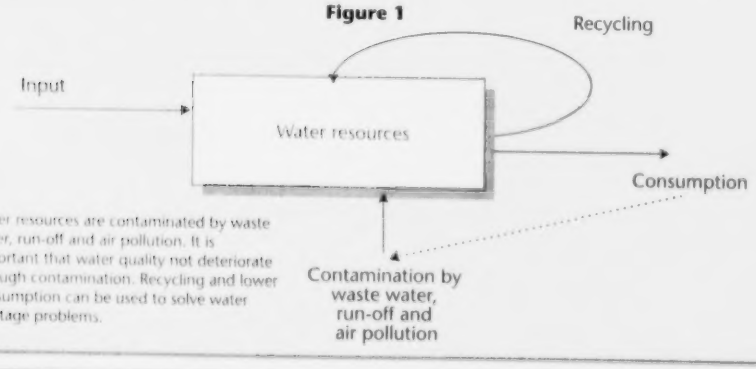
A flow chart or conceptual diagram is a good tool to use to find the right recycling solution, but this solution requires creative thinking about the many possibilities for recirculation. Each solution will inevitably be different, due to different industrial structures, water resources, water consumption patterns, water quality and geography. Therefore, a general solution does not exist. A specific solution has to be found that takes into account many site-specific aspects.

Residential areas

Two approaches have been used to reduce demand for water in residential areas:

- reuse of "grey" waste water (from kitchens and baths) for toilet flushing following partial treat-

Figure 1



Water resources are contaminated by waste water, run-off and air pollution. It is important that water quality not deteriorate through contamination. Recycling and lower consumption can be used to solve water shortage problems.

Experimental waste water treatment in Tanzania

At an experimental waste water treatment plant in Tanzania using two steps, *waste stabilization ponds* (three-week retention time) and *constructed wetland* with subsurface flow, the following results were obtained:

	Before treatment	After treatment
BOD5	190 mg/l	8 mg/l
COD	75 mg/l	4 mg/l
Total N	35 mg/l	11 mg/l
Total P	11 mg/l	1.2 mg/l
E. Coli	10^7 counts/ml	0 counts/ml

ment (partial biological treatment, plus combined UV radiation and ozonation), as conceptualized in Figure 4; or

- collection of rainwater to be used for toilet flushing after filtration and UV treatment.

Both methods have been studied in Denmark. A 25-35% reduction of water consumption is possible, but at a cost of two to three dollars per cubic metre. The relatively high cost is due to the small (local) scale. The methods are therefore not competitive, unless water resources are very limited or significant green taxes are imposed on water consumption and waste water discharges as is done in Denmark. The cost of the multi-step treatment used in Pretoria and Windhoek would today probably be around five to seven dollars a cubic metre, suggesting that use of partially treated water for toilet flushing could offer realistic solutions where water resources are very limited.

Reducing consumption

The problem of water shortage may also be solved by reducing water consumption. An incentive such as applying a green tax to water consumption and waste water discharge would strongly support this solution.

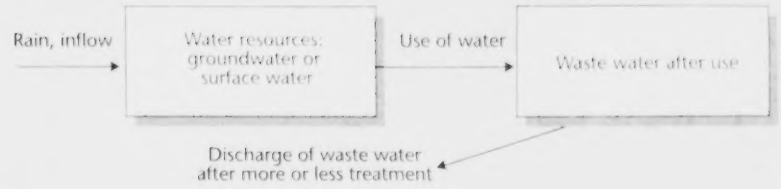
There have been numerous examinations of water consumption patterns. They all indicate that there are many possibilities to reduce water consumption in industries, agriculture and households.

A few possibilities with regard to households should be mentioned: using less water for toilet flushing, eliminating dripping taps, and using showers instead of bathtubs. In agriculture, more effective drip irrigation methods can reduce water consumption considerably. With these methods a realistic reduction in the order of 25-30% can be achieved. Water demand in Denmark was reduced by 20% between 1980 and 2000 through applying this policy.

Protecting water resources

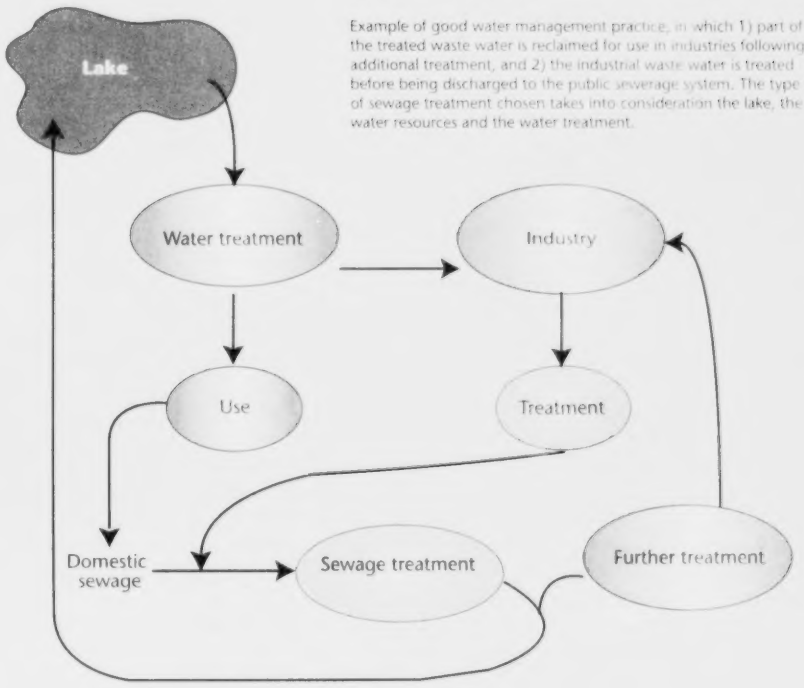
The most important method of protecting urban water resources is probably not to contaminate them, at least to the extent of making water useless economically or technically. The cost of restoring a completely deteriorated water resource is greater than that of preventing contamination in the first place. It is therefore beneficial to devise an environmental management plan for water

Figure 2


Rain, inflow
Water resources: groundwater or surface water
Use of water
Waste water after use
Discharge of waste water after more or less treatment

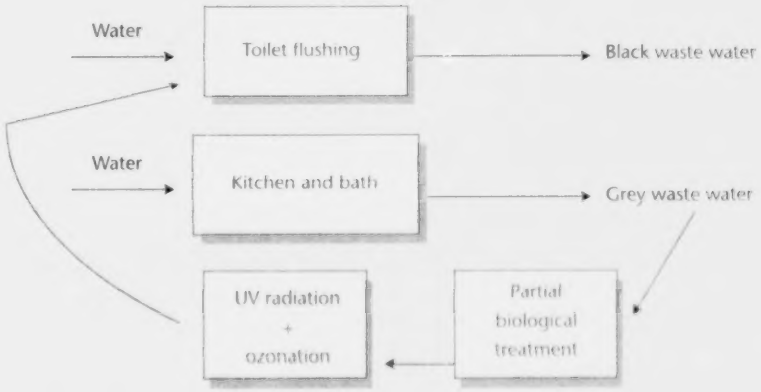
Water supply and waste water problems are considered independently. No recycling takes place, and the waste water may be discharged to the source of potable water. There is no coordination between waste water discharge and the supply of potable water.

Figure 3



Example of good water management practice, in which 1) part of the treated waste water is reclaimed for use in industries following additional treatment, and 2) the industrial waste water is treated before being discharged to the public sewerage system. The type of sewage treatment chosen takes into consideration the lake, the water resources and the water treatment.

Figure 4



"Grey" kitchen and bath waste water is given partial biological treatment, followed by UV radiation and ozonation. This partially treated grey waste water can be used for toilet flushing. The Danish experience is that water consumption can be reduced 25-35% with this approach.

resources, including their application and conservation, at an early stage.

Water resources can be contaminated in a number of ways. For example:

- Where treatment has been inadequate, discharges of toxic substances may have deteriorated surface water quality. This problem can be solved through sufficient waste water treatment or intensive treatment of the surface water (filtration, precipitation, sedimentation, chlorination, activated carbon adsorption) before it is used as drinking water. Either solution may be very costly. It is usually much less expensive to remove toxic substances at source, for instance before industrial discharges are sent to the municipal sewerage system, or to prevent their presence in waste water by some other means.
- Inadequate removal of biodegradable organic matter and/or nutrients may cause anoxic conditions and/or blue-green algae blooms excreting toxicants. The water quality of lakes and reservoirs would therefore be critically reduced, possibly to an unacceptable level. This is the case with the Billing's Reservoir in São Paulo (Brazil), which is used as a major water resource. The least expensive solution to the problem is definitely to treat the waste water properly before it is discharged.
- Use of pesticides near lakes and reservoirs or groundwater resources may result in contamination and deterioration of water resources. Legislation limiting the application of pesticides near water resources seems necessary to prevent such contamination and is used in many countries.

In many developing countries, the main obstacle to implementing an adequate waste water technology is the high cost. An investment of $100-500 per person is generally needed for two- to four-step treatment, which is what would be required in many cases. However, chemical precipitation alone can often provide a good solution at a much lower cost. Chemical precipitation results in 60-70% removal of BOD5, COD and nitrogen and 85-98% removal of phosphorus (Jorgensen, 2000b). The latter is often sufficient to reduce eutrophication to an acceptable level.

Sustainable management of Japan's Lake Biwa-Yodo River water system

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The Lake Biwa-Yodo River water system supplies municipal and industrial water to major population centres and their surrounding municipalities. It also provides water for agriculture, mostly in the Lake Biwa watershed. The combined population served is some 14 million.

This water system forms the backbone of the industrial region called Keihanshin (which literally means Kyoto, Osaka and Kobe), an area characterized by developments along the Osaka Bay-Seto Inland Sea strip. Keihanshin has the third largest industrial output among Japan's regions, or about 12.4% of GDP. A complex web of water supply and wastewater networks supports a high level of municipal, industrial and agricultural activities.

Historically, this water system has been subjected to many large-scale human interventions, particularly with respect to flood control and the development of water resources. The latest and the most important of these interventions is the 25-year Lake Biwa Comprehensive Development Project (LBCDP) completed in March 1997. This project has increased Lake Biwa's discharge capacity up to a maximum of 40 m^3/sec, in order to meet downstream needs (largely those of the Osaka area) at times of severe drought. The upstream Shiga Prefecture, in whose jurisdiction Lake Biwa lies, has benefited from the LBCDP's compensatory regional infrastructure development projects to become one of the wealthiest parts of Japan.

The improved water resource systems and infrastructure around Lake Biwa will promote further development and alteration of the watershed, but this will also bring about environmental degradation of a more complex nature. Water quality issues are now intertwined with those of quantity, making management of the Biwa-Yodo system extremely challenging for both the upstream Shiga Prefecture and the downstream metropolitan areas.

Urban water supplies

There are a large number of water supply systems in the Biwa-Yodo system: 87 municipal, 292 sub-municipal or rural, and 63 industrial. While the demand for municipal water has been increasing, industrial demand in this area has steadily decreased, mostly due to the changing nature of its industrial activities.

The Kyoto water supply system, which includes four purification plants, is almost totally dependent on water from Lake Biwa. The Lake Biwa canals (the Biwako Sosui, one of which was completed in 1890 and the other in 1970) can provide 23.35 m^3/sec of lake water, much more than the city needs. The major concern in regard to the Kyoto purification plants is the early summer taste and odour problems caused by certain species of phytoplankton (e.g. *Oscillatoria*, *Phormidium* and *Anabaena*) found in Lake Biwa's water.

The Osaka city water supply systems receive raw river water from the Yodo, with a total allocation amounting to 23.491 m^3/sec or about 203 million m^3/day. The quality of the water going to its water purification plants is significantly affected by the quality of the water from Lake Biwa, as well as the that of the water draining to the Yodo from its tributary rivers and watercourses. Osaka's water treatment systems are among the most advanced in Japan.

The small and medium-sized municipalities in the suburban Osaka area receive water from the Prefectural Water Supply Utilities. This wholesale water distributor serves 39 such municipalities. A similar wholesale system, operated by the Hanshin Water Supply Corporation, provides water to municipalities in the western part of Osaka Prefecture and to the eastern part of Hyogo Prefecture, including the city of Kobe.

There are several industrial water supply systems in the city of Osaka (271,400 m^3/day) as well as in Osaka Prefecture apart from the city (344,000 m^3/day).

Pollution control and wastewater management

Water pollution control in the Biwa-Yodo region has been just as complex as the development of its water resources. The key element of pollution control has naturally been the development of sewerage systems.

The city of Osaka now boasts nearly 100% coverage by the sewerage system in its jurisdiction, as well as the cheapest per capita sewer services charges in Japan. Frequent flooding in the coastal area has required the city to address wastewater problems using a combined sewerage system. The major challenge the city faces today is rehabilitating the existing combined system to a separate system (only 1.1% of the whole system is now separate).

The city of Kyoto's sewerage system, whose overall coverage has now reached 97%, is characterized by a combination of combined and separate sewers, meaning some 40% of wastewater may have to be released to watercourses after heavy storms. There are four municipal wastewater treatment plants, each giving specific consideration to treatment of wastewater discharged by various industries, including traditional local ones such as textile dying and distillation of sake.

The Kobe wastewater system is largely separate. Nearly 1.2 million m^3 of wastewater per day is treated by seven plants, four of which are located along the Seto inland sea. The city's terrain, consisting of urban developments on reclaimed coastal land, hillsides and an upper plateau region, results in individual systems being independent and separate compared with those of the other two municipalities. The earthquake in 1995 seriously damaged the sewerage networks and treatment plants, whose rehabilitation is still a major problem. In addition, the city is working towards introducing an advanced treatment system for removal of nutrients to protect the Seto inland sea from further eutrophication.

The level of investment in the development of wastewater systems other than these three large metropolitan ones has increased significantly in the past decades. In the case of Osaka Prefecture apart from Osaka City, there are 12 regional wastewater systems accommodating some 42 municipali-

Local precipitants are often available with the same or slightly lower efficiency; for instance, clay minerals. Toxic substances, including heavy metals, are removed with approximately the same efficiency as is BOD5, i.e. 60-70%, a considerable improvement compared to lack of any treatment. It is therefore recommendable to examine the possibilities of applying chemical precipitation, and to evaluate its effect on the quality of available water resources.

The combination of stabilization ponds waste and constructed wetlands offers another attractive waste water treatment solution. About 90% or more removal of BOD5, COD, nitrogen, phosphorus and toxic substances can be achieved. This relatively inexpensive approach works well all year round in tropical regions (Jørgensen, 2000c). The disadvantage is the amount of land required. Where land is not too expensive, this could be an attractive solution in developing countries.

Conclusion

It is not possible to draw very general conclusions that could be used in all practical cases. Every case needs to be examined and specific solutions found that best suit local conditions. In our endeavour to find the best possible solutions, it is probably necessary to work with many of the methods above at the same time. In accordance with this short overview, it can be concluded that simultaneous use of recycling, reduced water consumption and adequate protection of water resources through legislation and waste water treatment will inevitably imply a very realistic and significant reduction of water demand.

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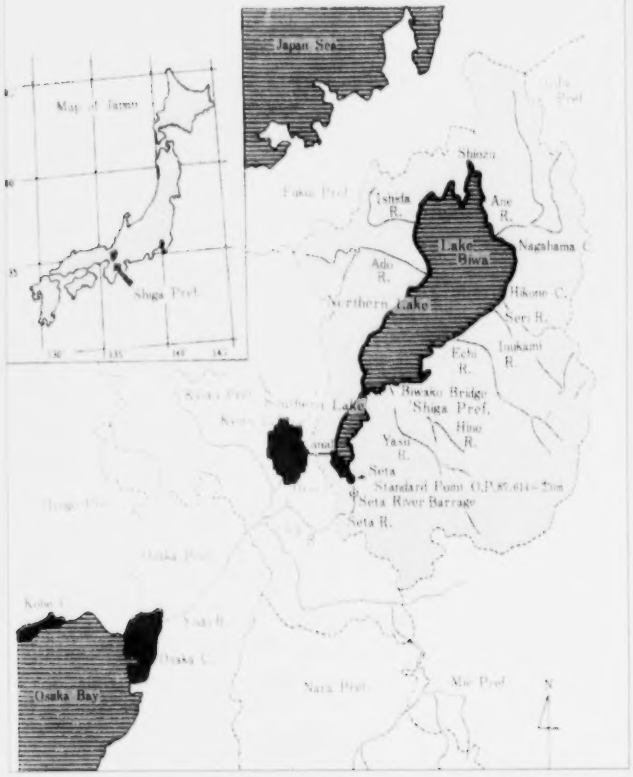
The Lake Biwa-Yodo River-Osaka Bay area and part of the Kansai Metropolitan Region



ties at various levels of service coverage, ranging from nearly 100% for four municipalities to less than 50% for 17 of them (as of 1995). The average service coverage for the whole Prefecture is 63.7%. In the case of Kyoto Prefecture apart from the city of Kyoto, two regional treatment plants in operation are of direct significance in protecting the quality of the water coming from the Yodo. The overall extent of service coverage was reported to be 73.6% as of 1995.

Integrated management of the Biwa-Yodo system

The Biwa-Yodo water system, as described above, is a highly integrated system of water management encompassing multiple urban developments, each with a unique development history. It has many of the features of a watershed system accommodating urban water needs that are typically found in other parts of the world as well. For example, downstream water needs have greatly affected development of the upstream water management system as reflected in LBCDP, in terms of both quantity and quality.

However, close examination the Biwa-Yodo system's evolution indicates that its integration has actually taken place over a considerable amount of time as a result of individual urban water systems fulfilling their own needs more or less independently. In other words, an integrated system of water management involving multiple urban developments should not only be viewed as a system to be designed from the top down, but also as one evolving from the bottom up. This observation, stemming from the Biwa-Yodo experience, could have rather far-reaching implications in the current debate on the need to promote greater integration of water management systems in the developing countries that are expected to experience tremendous urbanization in the decades ahead.

Of course, the question arises as to whether the Biwa-Yodo system has reached a satisfactory level of integration. To address this question, there are still some important issues to highlight, with particular reference to quality management. First, control of point source pollution in the upstream regions is still inadequate, lagging far behind that in the metropolitan districts, i.e. Kyoto, Osaka and Kobe. In the Lake Biwa watershed, only 30% of the prefectural population (as of 1995), or 43% of the planned service population, is connected to sewerage. The rest is served by community-scale systems and various types of on-site systems. The overall extent of sewerage coverage in the entire Lake Biwa-Yodo watershed, other than in these three metropolitan districts, is around 60-70%.

Second, control of non-point source pollution is of greater concern every year. Two aspects of non-point pollution need closer examination. The first is the agricultural character of the Lake Biwa watershed; the second is the urban character of this pollution, in the Yodo portion of the watershed in particular.

Agricultural non-point pollution is of concern because of its contribution of organic substances as measured in chemical oxygen demand (49%) and total nitrogen (56%), and its contribution of pesticides. As control of point sources becomes increasingly stringent, the share of agricultural non-point pollution becomes greater. Controlling it will not be easy. Urban non-point pollution is causing growing concern. Urban run-off contains highly toxic substances, including heavy metals and trace organics in which there are some endocrine disruptors.

Conclusion

The complex system of Lake Biwa-Yodo River water management has not yet reached a satisfactory level of sustainability. In pursuing sustainability, a number of different physical systems and managerial approaches have evolved in the region – in the metropolitan districts of Kyoto, Osaka and Kobe, in the suburban municipalities outside these metropolitan districts, and in the Lake Biwa watershed's urban and semi-urban areas. Further increases in sewerage coverage are imminent in Shiga Prefecture, not only due to the need to reduce the water quality control burdens of downstream municipalities but also because of the need to upgrade basic environmental infrastructure provision for the watershed population.

Challenges of providing drinking water for urban and peri-urban slums from groundwater resources in hard rock terrain in India

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Abstract

In western India's hard rock terrain, groundwater is the main source of water supply to urban and peri-urban slums. These slums are not connected to the municipal water supply and drainage network. A bore well with a hand pump, providing water for about 200 people, is usually the least-cost way to provide safe drinking water. Full remediation of contaminated groundwater may not be practicable.

Résumé

Dans les terrains rocheux de la partie occidentale de l'Inde, les nappes souterraines sont la principale source d'alimentation en eau pour les bidonvilles urbains et péri-urbains, non raccordés au réseau municipal de distribution d'eau et d'évacuation des eaux usées. Un puits muni d'une pompe à main desservant environ 200 personnes est habituellement le mode de distribution le moins coûteux. Mais l'assainissement total des nappes souterraines contaminées n'est pas toujours réalisable.

Resumen

En los terrenos rocosos de la India occidental las aguas subterráneas son las principales fuentes de recursos acuíferos de los suburbios urbanos y periurbanos. Estos suburbios carecen de conexión con las infraestructuras de distribución y alcantarillado municipales. Por lo general, el medio más rentable para proveer de agua potable a unas 200 personas es un pozo dotado de un sistema de bombeo manual. Sin embargo, el tratamiento de napas freáticas contaminadas no siempre resulta posible.

Introduction

In a developing country like India, most cities and towns obtain their water supply from a surface water source such as a river, lake or canal. Following some treatment at a water treatment plant, this water is distributed through a network of pipelines. Groundwater in urban areas is usually viewed as an auxiliary or emergency supply, mainly for external use. In some cities, if groundwater must be used for drinking purposes, urban residents have resources and facilities to test the water and purify it by boiling or ultraviolet treatment. If surface water is polluted due to industrial development in a catchment area or discharges of untreated industrial effluent, drinking water quality may deteriorate and become a serious problem in urban areas.

Urban citizens have political and economic clout. Their problems are immediately given attention in the newspapers or state legislature, and remedial measures are taken. The water quality problems of urban slum dwellers, who are not connected to the municipal water supply network, do not receive such immediate attention and action. Slum dwellers are mainly concerned with just obtaining an adequate quantity of water from a nearby bore or dug well. The amount available from groundwater resources is therefore overwhelmingly important. Quality considerations are ignored until quality deteriorates to such an extent that water from the drinking water supply bore or well becomes totally unacceptable. It is possible that within the limits of tolerance for colour, odour and taste, slum dwellers drink polluted water out of sheer ignorance as well as need. Surface water of any quality is acceptable for external use, but the surface water in urban areas is so polluted that the usual practice is to dig a well beside a stream and use the water from it.

Like the urban slums not serviced by a municipal water supply network, peri-urban slums depend on groundwater as their only source of drinking water. Some of these slums are in the upstream direction of surface water flow and the up-gradient direction of groundwater flow, with respect to an urban agglomeration. These slums enjoy better surface water and groundwater quality. Typically, they are located beside a canal or pipeline bringing water to a municipal water treatment plant. On the other hand, the surface water and groundwater of slums located in the downstream or down-gradient direction have been highly polluted. Typical water pollution situations in these cases arise due to:

1. pollution of surface water by industrial effluent discharged into rivers or streams, and pollution of groundwater by leakages and spills from industries;
2. pollution of surface water by storm water, untreated sewage and waste water flowing from an urban agglomeration into a river or stream;
3. pollution of surface water by residential and industrial development in the vicinity of a reservoir, river or canal supplying water to an urban area; and
4. pollution of groundwater in shallow aquifers due to leakage from septic tanks, soak pits and sewage lines of urban areas.

Besides these external sources of pollution, there are local sources within the slums, such as manure pits, pit latrines and waste water from houses and stables that pollute the groundwater available from the bore or well.

Constraints

The challenge of providing safe, pollution-free drinking water to slums in urban and peri-urban areas involves several constraints, such as:

1. absence of effective implementation of "pollution control regulations" for industries and civic authorities;
2. absence of effective land use planning for urban and peri-urban areas;
3. the limited technical and financial capacity of industries and urban civic authorities;
4. lack of awareness by slum dwellers; and
5. lack of funds by slum dwellers' societies or unions.

Absence of effective implementation of "pollution control regulations" for industries and civic authorities

Early in India's industrial development, industries had no regulations for effluent treatment or solid waste disposal. Some regulations are now in place, but the implementing agency in the government is highly inefficient and lacks the technical man-

power to enforce them. Political decisions often delay regulations' enforcement. Violations are overlooked. Some of the worst polluting industries are owned, wholly or partly, by government or semi-government corporations. Moreover, civic authorities have no guidelines to observe that would limit the degree to which they can pollute a stream or river flowing through an urban area or to an aquifer underlying it.

Absence of effective land use planning for urban and peri-urban areas

In the vicinity of urban areas, changes in land use zoning, from agricultural or pastoral to residential or industrial, in urban planning schemes is influenced by external, non-technical influences. These multi-million dollar decisions are controlled by vested interests, with the result that residential and industrial developments take place even near reservoirs supplying water to major cities.

For example, there has been extensive and uncontrolled residential development, including slums, along 10 km of an open canal bringing drinking water from a lake to Poona (Pune), a city in western India with a population of about 2.5 million. The canal is not fenced. At its head the *E. Coli* count per 100 mL is about 5, using the most probable number (MPN) method; by the time the canal reaches the city's raw water pumping station 10 km away, the count is about 2500 (Limaye 1997). In most developed countries, an *E. Coli* count of zero per 100 mL is required for potable supplies. There are examples in some other cities of industrial development taking place over the recharge area of important aquifers.

Limited technical and financial capacity of industries and urban civic authorities

Due to the very steep increase in the population of urban areas, Indian civic authorities are already heavily burdened with the responsibility of providing water and drainage facilities for the ever-increasing population connected to water supply networks within the city limits. As water quality deteriorates, treatment costs increase. Citizens served by supply networks want good quality water, but they are reluctant to pay higher water bills. There are also other problems to address, including traffic congestion and air and noise pollution.

Technical and financial constraints on civic authorities permit only a certain amount of water treatment at each end (i.e. raw water purification, and treatment of waste water generated by the urban population and by industries served by the water supply network). Industries that operate at a loss or are marginally profitable may run effluent treatment plants during the daylight hours only and discharge untreated effluent at night. Streams and rivers in the vicinity of urban industrial agglomerations carry highly polluted water several kilometres downstream. Slums, where there are drinking water wells on the banks of such streams/rivers, often abstract water that is polluted due to seepage of river water into the groundwater. Similarly, groundwater obtained from bores in slums on the down-gradient side of aquifers coming from urban areas is often highly polluted.

Lack of awareness by slum dwellers

Slum dwellers are usually unaware of pollution in their water supply unless the water's colour, taste or odour becomes intolerable to them. In rural areas, once this limit is exceeded, and if the polluter is an industry, farmers pressure the industry to provide compensation for real as well as imaginary losses. The industry attempts to convince the farmers and slum dwellers that their losses, if any, are minimal. An amicable solution can be reached only if both sides abandon their extreme positions. This is usually possible through mediation by social workers and NGOs. The involvement of leaders of farmers unions and politicians has often made such negotiations difficult. If the polluter is a civic authority, slum dwellers do not receive any monetary compensation. The only compensation in such cases could be extension of the city water supply network to the affected slum.

Lack of funds by slum dwellers' associations

Slum dwellers' societies or unions cannot afford to hire technical experts and operate drinking water purification plants to treat the polluted water available from drinking water bores or dug wells. The only alternative is to convince civic authorities to extend water supply pipelines from a neighbouring urban area, or to seek another suitable location where a well to supply drinking water could be drilled or dug.

In developing countries, under these constraints the challenge is not necessarily to achieve full remediation or purification of polluted water resources but to identify a practical solution/strategy to address the lack of drinking water, especially in pollution-affected slums.

The role of technical experts

In the next two decades or so, over 50% of the population of many developing countries will probably live in urban centres; about 60% of these people are likely to live in urban and peri-urban slums. Providing drinking water supply and sanitation facilities for these poor slum dwellers is the greatest challenge faced by engineers, city planners, hydrologists, environmental engineers and hydrogeologists. As slums expand in the surface water catchment areas or along canals bringing raw water to urban water treatment plants, the quality of raw water will deteriorate and the cost of water treatment increase.

Urban centres are large consumers of good quality water. They also produce large quantities of polluted waste water which, after some treatment at an effluent treatment plant, is discharged to the nearest stream or river. For several kilometers in the downstream direction, this water is mostly unfit to drink. Groundwater in urban areas is polluted due to:

- leakage from sewers, waste water drains, effluent lines, septic tanks, and underground storage of chemicals and petroleum products;
- leachate from solid waste dumps and landfills located in aquifer recharge areas;
- chemical spills; and
- seepage from storm water drains and polluted streams.

Against this background, technical experts working in government departments, civic authorities, universities and NGOs face the challenge of providing safe drinking water to the urban poor or slum dwellers, who are the most neglected (but ever-growing) class in urban society. Slum dwellers can be helped in the following ways:

1. In slum areas where groundwater is likely to be available, bores can be drilled up to about 60-80 metres deep, providing PVC casing pipe to a depth of 10-15 metres below ground level or to hard rock, whichever is greater. This minimizes entry of shallow percolation water. A bore with a hand pump usually serves up to 200-250 people. The bore should be located about a hundred meters from the slum area, in an up-gradient direction.

At a location north of Mumbai (Bombay), a chemical dyestuff factory used to treat its effluent water before discharging it to a nearby stream. Over the years the underground pipeline carrying the effluent water from the dyestuff manufacturing plant to the treatment plant developed leaks. This caused severe pollution of the shallow groundwater body, which had a natural gradient towards the stream. Shallow wells dug beside the stream started to furnish brownish water with an offensive smell and could no longer be used as sources of drinking water by nearby localities. When factory management was made aware of the situation, remediation was immediately begun by drilling bore wells up to about 80 metres deep a short distance from the stream bank and the affected localities. PVC casing pipe was provided up to 12 metres in depth, so as to prevent polluted water entering the wells. The cost of the wells and hand pumps was borne by the factory.

2. In some slum areas, groundwater is unavailable due to the hard and massive nature of strata. If there is a polluted stream nearby and there is a good sandy deposit on the stream bank, a well dug on the bank about 15-20 metres from the stream provides water of acceptable quality. The dug well is regularly dosed with bleaching powder. If the water in the main stream is chemically unsuitable, it is often possible to locate a spot for well digging in a tributary catchment.

In a peri-urban location near Poona (Pune), an industrial estate (park) developed on one side of a stream spoiled the quality of its water due to inefficient operation of the effluent treatment plants installed by many of the industries. Wells dug on the stream bank could not be used by residential localities to obtain drinking water. Luckily, there were no industries on the other side of the stream. It was therefore possible to locate a small tributary valley joining the stream from that side and dig a well about 50 metres from the main stream. Funds for the dug well were provided by a philanthropic society, as no single industry came forward to assume responsibility for the pollution.

In a few cases where groundwater and surface

water are both absent, the only feasible solution is to extend a connection from the municipal water pipeline to the slum area and provide a few public water taps. Funds which would be wasted on dry bores or wells are thus fruitfully used. There are several instances of members of civic bodies, elected from such slums, taking the leading role in providing this amenity.

Conclusions

People in urban and peri-urban slums that are not connected to the water supply network of urban and industrial areas often drink polluted groundwater without knowing that it is polluted. This is especially so if the problems with the water's colour, odour or taste are not within the limits of human sensory detection. It is up to hydrogeologists to select proper sites for well digging/drilling in order to obtain better quality water.

In a developing country like India, remediation of polluted surface water or groundwater resources in urban centres is far from ideal. Complete clean-up is impossible due to technical and financial constraints within the given social and legal framework. Industries should minimize pollution rather than face technically difficult and costly remediation. Such remediation, however, may never be satisfactory.

Hydrogeologists, social workers and NGOs play an important role in identifying the problems of slum dwellers and improving their quality of life.

Reference

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Le nouveau schéma d'assainissement de la Concession d'Aguas Argentinas : un outil contribuant à résoudre la problématique environnementale de la ville de Buenos Aires

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Abstract

The growth of Buenos Aires has been accompanied by increasing environmental degradation, including deterioration of surface water quality. In 1993, as the situation was clearly worsening, the government privatized drinking water provision and water treatment for a period of 30 years in Buenos Aires and 17 suburban municipalities. As requested by public authorities, Aguas Argentinas, which is operated by the Groupe Lyonnaise des eaux, has proposed and put into effect a master plan for water treatment that will contribute to solving environment-related problems.

Résumé

La croissance de la ville de Buenos Aires s'est accompagnée d'une dégradation progressive de l'environnement dont la qualité des cours d'eau. La situation globale s'étant nettement détériorée, le gouvernement a privatisé, en 1993 et pour une durée de 30 ans, les services d'eau potable et d'assainissement de la ville de Buenos Aires et de 17 communes de sa banlieue. Aguas Argentinas, dont l'opérateur est le Groupe Lyonnaise des eaux, répondant aux demandes des Autorités a proposé et mis en route un nouveau schéma directeur de l'assainissement qui contribuera à résoudre la problématique environnementale actuelle de la Concession.

Resumen

El crecimiento de Buenos Aires se ha visto acompañado por su creciente degradación medioambiental, que ha alcanzado también a la calidad de las napas de agua superficiales. En 1993, ante el claro deterioro de la situación, el gobierno privatizó los sistemas de abastecimiento de agua potable y tratamiento de aguas de la ciudad y otras 17 municipalidades suburbanas, durante un periodo de 30 años. A petición de las autoridades locales, Aguas Argentinas, regida por el grupo Lyonnaise des eaux, ha propuesto y puesto en vigor un plan general de tratamiento de aguas que contribuirá a resolver los problemas ecológicos asociados.

Introduction

La ville de Buenos Aires héberge plus de 10 millions d'habitants, presqu'un tiers de la population totale du pays et concentre une grande partie de l'activité économique de l'Argentine (Figure 1).

Historiquement, le fleuve Rio de la Plata a permis le développement de la ville en tant que principal port du pays, assurant ainsi sa croissance économique basée, en particulier, sur les industries associées à la production et à l'exportation de la viande et du cuir, mais aussi sur l'approvisionnement général d'une grande ville comme Buenos Aires.

Malheureusement ce développement a entraîné une dégradation systématique de la qualité des principaux cours d'eau. A cela s'est ajouté l'effet de non-investissement de l'Etat, pendant plus de 50 ans, dans des infrastructures d'approvisionnement en eau et d'assainissement et dans une aide économique aux industriels pour s'équiper en usines de traitement ou en technologies propres. En outre, la croissance démographique des banlieues qui se sont développées autour de Buenos Aires, dans des zones non desservies, a apporté une nouvelle composante sanitaire et sociale à la problématique environnementale. Tous ces facteurs ont fait qu'au début des années 90 la situation était très détériorée.

En 1993, l'Etat argentin a privatisé les services

d'eau potable et d'assainissement du conglomérat urbain de Buenos Aires (la ville plus 17 départements périphériques) en confiant l'opération de cette Concession au Groupe International Lyonnaise des eaux, à travers Aguas Argentinas, pour une durée de 30 ans. Pendant les premières années de la Concession, d'importants efforts ont été fournis pour améliorer radicalement les services : qualité et pression de l'eau distribuée aux clients et curage du réseau d'assainissement, qualité du service aux clients et expansion massive du service (2,6 millions d'habitants supplémentaires ont maintenant accès au réseau d'eau potable ou d'assainissement), construction du premier des deux modules d'une station d'épuration d'eaux résiduaires urbaines ayant une capacité de traitement de 600.000 Equivalent Habitant (EH) et construction d'un grand fleuve souterrain de distribution en eau potable (10 m³/s) qui permettra de nouvelles expansions dans des zones non desservies à ce jour.

Aujourd'hui, la ville de Buenos Aires veut récupérer ses cours d'eau, valoriser ses rivages, développer des projets urbains, offrir à ses habitants de nouveaux lieux de loisirs et de promenade.

Aguas Argentinas a proposé aux autorités un nouveau schéma directeur d'assainissement visant à améliorer la qualité des cours d'eau dans la zone d'influence de la Concession. Celui-ci est en cours de réalisation.

Ce plan est basé à la fois sur un diagnostique exhaustif de la qualité des eaux et une bonne compréhension des processus hydrodynamiques, chimiques et biologiques qui la contrôlent, et sur une connaissance approfondie de l'état et du fonctionnement des installations de la Concession (usines, réseaux, stations de pompages, etc.). La mise en route de ce plan s'insère avec cohérence dans le plan d'investissement global de l'entreprise, permettant une forte amélioration de la problématique environnementale en accord avec l'équilibre économique et financier de la Concession.

Le but poursuivi est la récupération progressive de la qualité des cours d'eau afin d'atteindre les objectifs de qualité fixés pour chacun d'eux et de permettre les usages définis comme nécessaires par la communauté (Figure 2).

La problématique environnementale de la ville de Buenos Aires

Caractéristiques hydro-morphologiques des cours d'eau

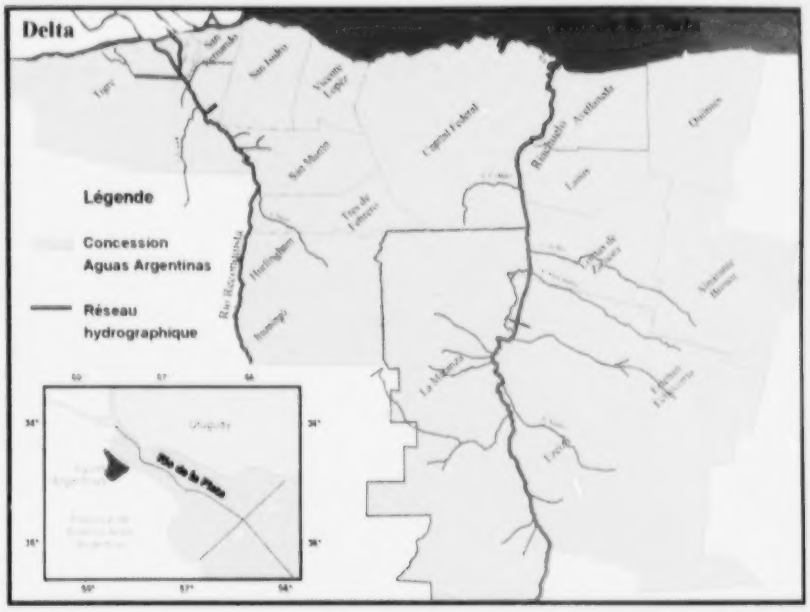
Le Rio de la Plata est en réalité un grand estuaire, il reçoit les apports d'un bassin versant de 31 000 km². La somme des débits moyens de ses deux principaux affluents, les fleuves Paraná et Uruguay, est de 20 000 m³/s, pouvant atteindre 140 000 m³/s lors de périodes de crues. Le Paraná apporte une très importante quantité de sédiments en suspension, en particulier des argiles. Il est par ailleurs responsable de la formation, en amont de la ville, d'un delta très étendu qui explique la couleur marron caractéristique des eaux du fleuve qui ont une concentration moyenne de 100 mg/l de matières en suspension (MES).

Bien que les eaux qui baignent la ville de Buenos Aires ne présentent pas de teneur en sel, le front salin se trouvant à 200 km en aval, il existe un effet de marée semi-diurne (marée astronomique) avec un marnage moyen de l'ordre d'un mètre, ce qui justifie la dénomination d'estuaire.

Cependant le fait le plus marquant du Rio de la Plata est sa grande largeur, 35 km à la hauteur de Buenos Aires et 120 km au niveau de son embouchure, et sa faible profondeur, 5 mètres en moyenne. Pour cette raison les vents qui caractérisent cette région, en particulier du Sud-Est et d'Ouest, provoquent de fortes variations du niveau du fleuve, celles-ci pouvant atteindre 4 mètres (marée météorologique) et causent en particulier d'importantes inondations dans la ville.

Le vent, et dans une moindre mesure, le débit flu-

Figure 1
La Concession d'Aguas Argentinas, ses départements et son réseau hydrographique

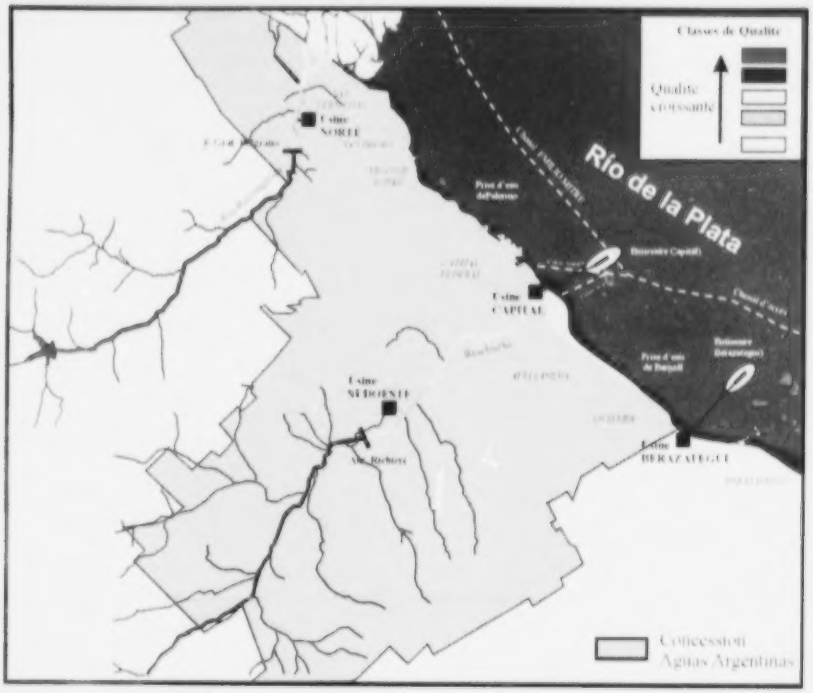


Niveaux de qualité des milieux récepteurs

Paramètre	Unité	Usage 1	Usage 2	Usage 3	Usage 4
PH	UpH	6,5-8,5	6,5-8,5	6,5-8,5	6,5-8,5
Oxygène dissous	mg/l	>5	>5	>3	>5
DBO_5	mg/l	<3	<3	<5	<3
Chlorures	mg/l	250	*	*	*
N-NH4+	MgN/l	<1,5	*	<2	<1,37
$N\text{-}NO_3^-$	MgN/l	<10	<10	10-20	*
$N\text{-}NO_2^-$	mg/l	<0,1			
CT	NMP/100ml	<5 000	<5 000	< 50 000	*
CF	NMP/100ml	<1 000	<2 000	< 20 000	*
Détergents	mg/l	<0,5	<0,5	<0,5	
Fenils	mg/l	<0,001	<0,001	0,001-0,05	<0,001
Cyanures	mg/l	<0,1	<0,1	<0,1	<0,005
Arsenicaux	mg/l	<0,05	<0,05	0,05-0,1	<0,05
Cadmia	mg/l	<0,005	<0,005	<0,005	<0,0002
Cuivre	mg/l	<0,1	<0,1	<0,1	<0,002
Plomb	mg/l	<0,05	<0,05	<0,05	<0,001
Zinc	mg/l	<5	<5	<5	<0,03
Chrome	mg/l	<0,05	<0,05	<0,05	<0,002
Sulfates	mg/l	<200	*	*	*
Dureté totale	mg/l	<100	*	*	*
Fluorures	mg/l	<1,5	<1,5	*	*

- * il n'existe pas de normes
- Usage 1 : Eau pour la consommation humaine avec traitement conventionnel
- Usage 2 : Eau pour loisirs avec contact direct
- Usage 3 : Eau pour loisirs sans contact direct
- Usage 4 : Eau destinée à la préservation et à l'exploitation de la vie aquatique

Figure 2
Objectifs de qualité des principaux cours d'eau dans la Concession de Buenos Aires



vial, sont sans aucun doute les facteurs dynamiques qui contrôlent la plupart des processus hydrodynamiques. Il s'agit toujours d'un milieu de forte énergie qui se traduit par l'absence de stratification verticale et par la bonne oxygénation de ses eaux.

La qualité des cours d'eau

Les caractéristiques du Rio de la Plata énoncées plus haut (fort débit et forte énergie) font que la qualité de ses eaux est bonne, si on la considère dans son ensemble. Cependant les nombreux apports pollués (pluviaux, ruisseaux, rivières, émissaires) le long de la rive, concentrés sur une bande collée à la côte, presque continue, conditionnent les usages du fleuve et en particulier la baignade (Figure 3).

Ces apports pollués proviennent de connections et déversements clandestins (domestiques comme industriels) mais aussi de débordements ponctuels du réseau d'assainissement. En outre, en Argentine comme dans la plupart des pays émergents, les insuffisances en matière d'assainissement domestique et industriel aggravent le problème de la pollution des eaux. Dans la ville de Buenos Aires, 90% des eaux usées domestiques sont encore rejetées dans le Rio de la Plata sans traitement et la plupart des industries ne traitent pas leurs effluents avant de les déverser dans le milieu récepteur ou dans le réseau d'assainissement. La Figure 4 présente le bilan des apports en matière organique qui sont déversés dans le Rio de la Plata.

L'approvisionnement en eau potable de la ville de Buenos Aires est assuré à 95 % par deux usines de traitement. Les prises d'eau se trouvent à 1,1 km et 2,4 km de la côte, en général en dehors de l'influence de cette frange polluée, ce qui permet de distribuer de l'eau potable avec une qualité répondant aux normes internationales.

Deux fleuves de faible débit, le Riachuelo et le Reconquista, traversent le conglomérat urbain. Ceux-ci se déversent dans le Rio de la Plata et présentent une qualité d'eau très dégradée. Ils sont caractérisés par le manque d'oxygène dû aux forts apports en matière organique, et donc par l'absence de vie, et par de fortes odeurs dues au processus de dégradation anaérobique, de fortes concentrations en bactériologie, hydrocarbures et détergents et des sédiments très pollués, en particulier par des métaux lourds comme le chrome et le plomb. Ces fleuves ne permettent aucun usage et constituent un risque sanitaire pour la ville de Buenos Aires.

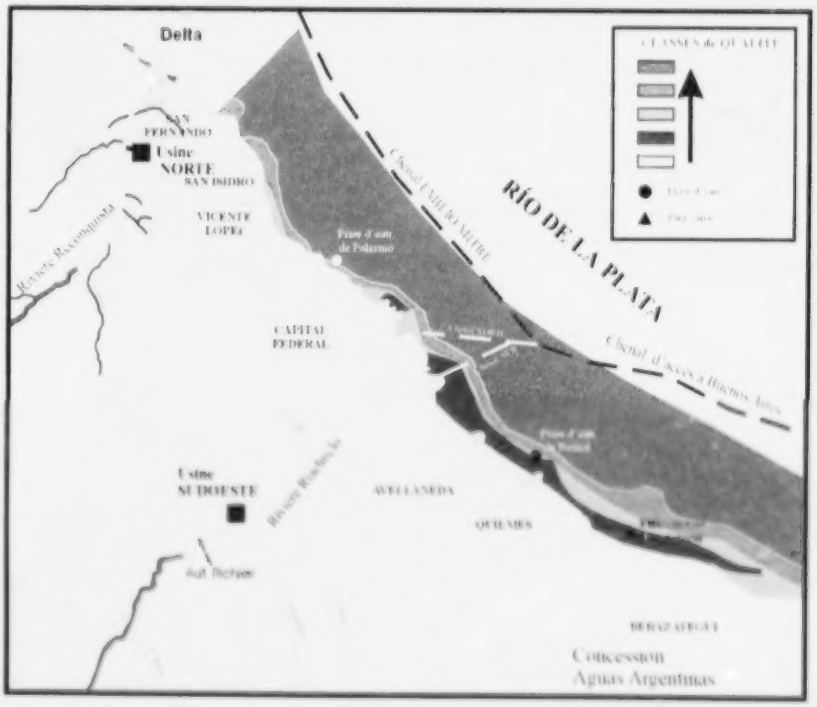
Enfin, même si sur un total de 10 millions d'habitants, 7,500,000 sont desservis en eau et 6,250,000 en assainissement, il reste encore des départements périphériques éloignés de la ville sans service d'eau potable ni assainissement. Il s'agit d'une population sans ressources, qui occupe des logements précaires dans des quartiers sans planification urbaine, et d'autre part de zones faiblement peuplées. Il en résulte une dégradation de la nappe phréatique et des ruisseaux qui contribue à la dégradation générale de tous les cours d'eau. Dans les deux cas, l'expansion du service reste complexe techniquement.

Le schéma directeur d'assainissement de la ville de Buenos Aires

Le réseau d'assainissement actuel

Il se caractérise par la présence d'un réseau de conduites de très grand diamètre qui courent parallèlement à la côte et se rejoignent à la station de pompage Wilde. Celle-ci envoie la totalité des effluents à un émissaire unique qui se trouve au sud de la ville de Buenos Aires, à 2,5 km de la côte (Figure 4). La grande majorité de ce réseau date de plus de 50 ans et dans certains secteurs comme dans les quartiers les plus anciens de la ville il est centenaire. Le réseau complet a une extension de 9.000 km de long et il est aujourd'hui à la limite

Figure 3
Analyse en composantes principales de la qualité des principaux cours d'eau dans la Concession de Buenos Aires



Evolution de la qualité de l'effluent à chaque station de traitement durant la concession

Station Nord		
Parametre	**Aujourd'hui (année 5)**	**Fin de la concession (année 30)**
Debit moyen traité, m³/s	0.5	1.8
DBO_5, mg/l	inférieur à 30	inférieur à 20
N-NH4, mg/l	inférieur à 10	inférieur à 10
Coliformes fécaux, NMP/100 ml	—	inférieur à 1,0 E4

Station Sud		
Parametre	**Aujourd'hui (année 5)**	**Fin de la concession (année 30)**
Debit moyen traité, m³/s	1.5	2
DBO_5, mg/l	inférieur à 30	inférieur à 20
N-NH4, mg/l	—	inférieur à 10
Coliformes fécaux, NMP/100 ml	—	inférieur à 1,0 E 4

Station Capital		
Parametre	**Aujourd'hui (année 5)**	**Fin de la concession (année 30)**
Debit moyen traité, m³/s	0	17,5
DBO_5, mg/l	0	inférieur à 50
N-NH4, mg/l	0	inférieur à 30
Coliformes fécaux, NMP/100 ml	0	inférieur à 1,0 E 4

Station Berazategui		
Parametre	**Aujourd'hui (année 5)**	**Fin de la concession (année 30)**
Debit moyen traité, m³/s	23	17,6
DBO_5, mg/l	130	inférieur à 50
N-NH4, mg/l	—	inférieur à 30
Coliformes fécaux, NMP/100 ml	—	inférieur à 1,0 E 4
Debit Moyen total	**25 m³/s**	**39 m³/s**
DBO_5, moyenne ponderee	**122 mg/l**	**47 mg/l**
Charges de DBO_5	**263.5 t/j**	**158.1t/j**

de sa capacité de transport, ce qui empêche la réalisation de nouvelles expansions de l'assainissement sans faire auparavant d'importants investissements en ouvrages primaires. Il existe, actuellement en opération, deux usines de traitement des eaux usées domestiques, l'usine Sud-ouest et l'usine Nord, qui ont respectivement une capacité de 650,000 EH et 300,000 EH et qui déversent leurs effluents dans les fleuves Riachuelo et Reconquista.

Le nouveau schéma directeur d'assainissement : le « Plan de Saneamiento Integral »

Le PSI prévoit un certain nombre de grands ouvrages d'infrastructure, à réaliser dans la durée de la Concession pour environ 1,000 millions de dollars (Figure 5). Ces ouvrages sont avant tout des ouvrages primaires permettant l'expansion du service d'assainissement, conçus pour contribuer à l'amélioration environnementale des cours d'eaux de Buenos Aires.

Ce plan incorpore des ouvrages d'interception qui ont pour but d'intégrer dans le réseau d'assainissement le débit de temps sec des pluviaux et les apports les plus pollués de la Concession, ceux-ci étant les principaux responsables de la dégradation des cours d'eau.

Il prévoit aussi la construction d'un nouvel émissaire de 7,5 km de long et le prolongement de l'émissaire actuel à la même distance, car ces zones ayant une importante capacité de diffusion et de transport. En tête de ces émissaires, l'entreprise construira des usines d'épuration et elle agrandira les usines existantes dans la limite du possible, étant donné que les rivières recevant leurs effluents ont un faible débit et que la qualité de leur eau est aujourd'hui très compromise.

D'autres ouvrages prévus sont des conduits de transport aux endroits où le réseau actuel a besoin d'être renforcé et également pour transporter les effluents des expansions du service des zones périphériques jusqu'aux usines d'épuration citées.

Enfin, des ouvrages de connexion entre le nouveau système et l'actuel sont prévus pour doter le réseau de transport d'une flexibilité inexistante aujourd'hui. Ils assureront aussi une sécurité renforcée dans l'opération du réseau de transport et permettront ainsi de faire face à d'éventuels travaux de réhabilitation ou de réparation des conduits, sans pour autant perturber le service.

Les études techniques et environnementales

Pour redéfinir la stratégie d'assainissement d'une ville comme Buenos Aires, il a fallu réaliser des campagnes de mesure sur le terrain très ambitieuses, des études d'ingénierie poussées et en particulier des études de modélisation des processus hydrodynamiques et de la qualité de l'eau des milieux récepteurs. Ces dernières, grâce aux simulations des différents scénarios de conditions futures, ont permis d'optimiser et de valider le nouveau schéma d'assainissement. Une fois le plan approuvé dans son ensemble, d'autres études spécifiques à chaque ouvrage, comme les projets d'ingénierie et les Etudes d'Impact Environne-

Augmentation de la couverture du réseau d'assainissement par plan quinquennal (PQ)

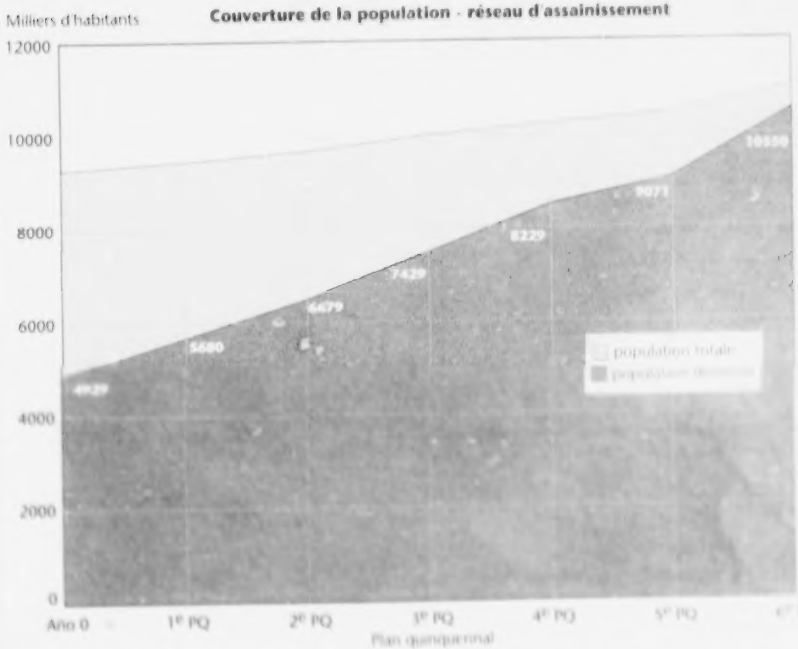


Figure 4
Réseau d'assainissement actuel de la Concession de Buenos Aires

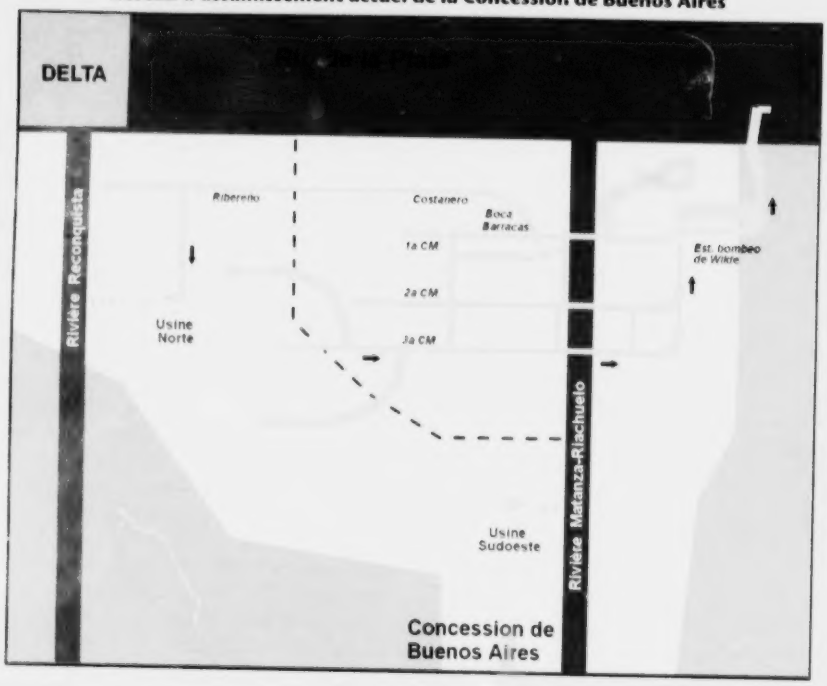


Figure 5
Ouvrages prévus dans le nouveau schéma directeur d'assainissement de la Concession de Buenos Aires

mental, seront menées en accord avec la programmation du plan.

Conclusion

Le nouveau schéma directeur de l'assainissement adoptée par la Concession répond à la prise de conscience par les habitants et les autorités de la problématique environnementale de la ville de Buenos Aires.

La décentralisation du réseau d'assainissement en deux sous-systèmes connectés entre eux donne au réseau de transport une flexibilité et une sécurité nécessaire pour une opération optimisée et plus sûre.

La capacité de transport supplémentaire apportée, non seulement par les nouveaux conduits, mais aussi par la flexibilité dans les conduits déjà existants, permettra la réalisation et l'incorporation des expansions futures du service de l'assainissement.

L'adaptation du nouveau schéma à l'acceptabilité des milieux récepteurs, la construction de deux émissaires modernes et la captation des débits de temps sec des pluviaux les plus pollués traduisent un changement radical de la politique d'assainissement en Argentine et répondent en partie à l'ambitieux projet de réhabilitation des rivages de la ville de Buenos Aires pour la satisfaction de ses habitants.

Les études techniques montrent la viabilité du projet global pour atteindre les objectifs de qualité fixés. Mais pour parvenir à cette meilleure qualité de vie, il faut une volonté politique et une participation de tous les secteurs de la communauté. Les sources de pollution qui échappent au cadre de responsabilité du concessionnaire, et en particulier les rejets industriels (le pouvoir de police appartenant à l'Etat), devront être contrôlés.

La mise en oeuvre du plan directeur d'assainissement d'Aguas Argentinas permettra des améliorations immédiatement visibles de l'environnement dès la mise en route des premiers ouvrages, prévue à partir de 2004. ◆

Urban environmental management

Energy management in practice: communities acting to protect the climate

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Abstract

The International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Protection Campaign works with local governments to reduce greenhouse gas emissions, using a comprehensive and strategic energy management approach. A sampling of the 386 local governments, in 43 countries, participating in the Cities for Climate Protection Campaign demonstrates that concrete actions have improved local energy management and reduced GHG emissions.

Résumé

La campagne " Cities for Climate Protection "du Conseil international pour les initiatives locales en environnement (ICLEI) a été lancée en collaboration avec des collectivités locales dans le but de réduire les émissions de gaz à effet de serre grâce à une approche complexe et stratégique de la gestion de l'énergie. Un échantillon de 386 collectivités locales dans 43 pays participe à la campagne, apportant la preuve que des actions concrètes permettent d'améliorer la gestion de l'énergie à l'échelon local et de réduire les émissions de gaz à effet de serre.

Resumen

El Consejo Internacional para Iniciativas Ambientales Locales (ICLEI) colabora con los gobiernos locales a través de la Campaña de Ciudades para la Protección del Clima, con el fin de reducir la emisión de gases de invernadero, sirviéndose de un enfoque integral y estratégico de la gestión de energía. Una muestra de 386 autoridades locales de 43 países, que participan en la Campaña de Ciudades para la Protección del Clima, testifica que las acciones concretas resultan en la mejora de la gestión local de energía y la reducción de la emisión de gases de invernadero.

The current report of the Intergovernmental Panel on Climate Change (IPCC) ratifies the conclusion arrived at in 1995: that human activity is the most significant cause of the increasing greenhouse gas emissions responsible for an accelerating increase in the Earth's surface temperature. The 1990s proved to be the hottest decade on record, with each month from May 1997 to September 1998 breaking the previous monthly world average temperature record.

What are the human activities the scientific community is referring to? The most substantial is the burning of fossil fuels, which releases CO_2, the major heat-trapping gas being added to the atmosphere. Deforestation, land clearance, and waste products from intensive agriculture and urban waste management practices also contribute. However, it is the 20th century's dependence on fossil fuels to fulfil energy needs – burning coal, oil or natural gas to generate electricity, power vehicles, heat and cool buildings, or manufacture products – that is the nucleus of the problem. Managing energy needs and changing energy sources are thus at the heart of the solution.

Political attention to this issue is largely focused on negotiations among national governments to reach agreement on the UN Framework Convention on Climate Change and to hammer out mechanisms to meet the emissions reduction targets in the Kyoto Protocol to the UNFCCC. Local governments are generally in the background of the international debate, but they have significant influence on GHG emissions throughout the world.

ICLEI's effort to understand the relationship between urbanization and climate change began in 1991 through the Urban CO_2 Reduction Project, which brought together a group of 14 US, Canadian and European cities to analyze communities' contribution to the release of greenhouse gas emissions and to develop a municipal planning framework for GHG reductions.[1] The hands-on research conducted by ICLEI staff and consultants and the participating cities revealed a striking correlation between the level of emissions in the community and factors such as population density, type of infrastructure, land use patterns, presence of transit options and transit system design, local building design, use of combined heat and power systems, and type of waste management practices. These factors, often wholly or partly controlled by local governments, have profound and long-lasting effects on the level of energy and fuel used, and waste generated, thus affecting the level of air pollution and greenhouse gas emissions emanating from a particular locality.

The lessons learned from the Urban CO_2 Reduction Project led ICLEI to initiate the Cities for Climate Protection (CCP) Campaign, which helps cities, counties, towns and other local authorities address global warming through a comprehensive and strategic energy management approach. Today, 386 participating local governments in 43 countries are taking concrete steps to improve energy management and reduce greenhouse gas emissions.

Cities influence energy use and global emissions

The human population increasingly lives in cities. As countries develop technologically and industrially, those that were largely rural are rapidly becoming urbanized, increasing the rate and quantity of energy use.

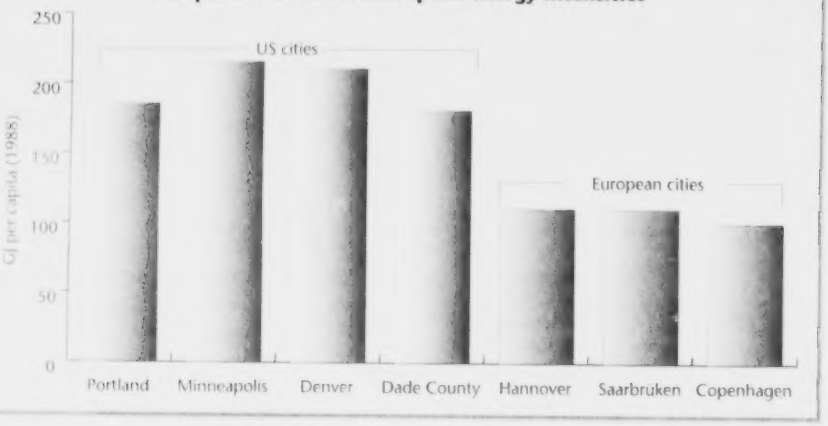
From the point of view of energy management, urbanization can be a curse or a blessing. Cities' physical form and organization have a profound effect on the level of energy use and the quantity of greenhouse gases emitted. In studying the differences between European and North American cities, the Urban CO_2 Reduction Project found that higher urban population densities facilitated urban settlement and development patterns, transit and transportation systems, and housing and building characteristics that resulted in lower per capita energy use. Yet population density was not in itself the determinant of energy use levels. Details in the planning, design and building of the European cities, such as transit and auto infrastructure, a mix of uses that put housing, jobs and services in proximity rather than separated by long distances, and incorporation of district heating and cooling systems, provided efficiencies in energy use that were absent in cities in North America (Figures 1-3).

The findings of the Urban CO_2 Reduction Project showed that local governments are in a unique position to affect energy use and reduce greenhouse gas emissions. While they cannot legislate carbon taxes or mandate nation-wide changes in the fuel mix for electricity or other energy supply, the facilities they operate and the decisions they make significantly influence present and future levels of energy consumed, fuel used and waste generated in the communities they serve.

Local governments have a critical role to play in the energy management and global climate change picture because:

- Decentralization of powers and authority from national governments to lower levels of government is expanding rapidly worldwide.

Figure 1
Comparison of US and European energy intensities



- Local governments own and operate buildings, vehicles, and facilities such as recreational facilities, street lighting and water supply and treatment that directly consume large quantities of fuel and electricity.
- Local governments manage and operate landfills and waste treatment plants, which are major sources of methane.
- Local government expenditures are a significant portion of GNP in most countries, giving local governments significant market influence with regard to vehicles, equipment and technologies.
- Local governments often control local land use policies, determining where buildings and development are located and the mix of uses allowed. Zoning, permits and municipal by-laws influence energy use by affecting residential and commercial density, residential access and proximity to services, transit accessibility and other factors.
- Local governments make or influence infrastructure decisions and investments, such as for roads and the type of transportation or transit systems.
- Local governments often have regulatory influence on, or responsibility for, building codes, determining the energy efficiency or inefficiency of the local building stock.
- Local governments manage and regulate automobile parking, traffic flow and transit systems, influencing the choice of travel mode and length of trip, which are significant determinants of transportation energy use.
- Local governments either own or control gas and electric utilities and district power operations, or purchase power from private utilities, providing the opportunity to influence the efficiency of power production and the fuel source used.

Cities for Climate Protection: a comprehensive approach to urban energy management

Working with local governments to achieve sustainable energy management is key not only to reducing the causes of global warming but also to resolving multiple urban economic and environmental problems. Most sources of air pollution emissions in cities are the same as those that release CO_2, the primary greenhouse gas. As with CO_2, the standard air pollutants – nitrogen oxides (NO_x), carbon monoxide (CO) and the volatile organic compounds (VOCs) that are precursors of ground-level ozone and smog – are by-products of fossil fuel combustion. Methane (CH_4), the second most significant greenhouse gas both globally and as a result of urban activities, is also a standard air pollutant. Because activities that produce CO_2 and methane emissions in urban areas overlap with air pollution sources, the CCP's methodology facilitates analysis and action towards the dual objectives of reducing GHG emissions and improving air quality.

The CCP takes a comprehensive approach to urban energy management, analyzing the use or misuse of energy in a variety of forms. The obvious form is the fossil fuel energy used for electricity, in vehicles and buildings or by industry. Less obvious are energy use and emissions represented by solid waste. Including waste management practices in the equation plays at least two roles in the energy cycle: it can reduce the amount of energy lost from mining and raw materials production, and can cut the methane emissions that result as the product decomposes.

Recognizing these energy forms and uses, the CCP is structured to encourage local governments to analyze all aspects of their communities' energy use – from fuel and electricity use to waste management and transport. The local government begins by collecting data on electricity and heating fuel used in the residential, commercial and industrial sectors, distances travelled and fuel consumed by vehicles, and quantities of waste generated and waste treatment methods. This information provides the local government a picture of the energy system and the emissions resulting from these various activities.

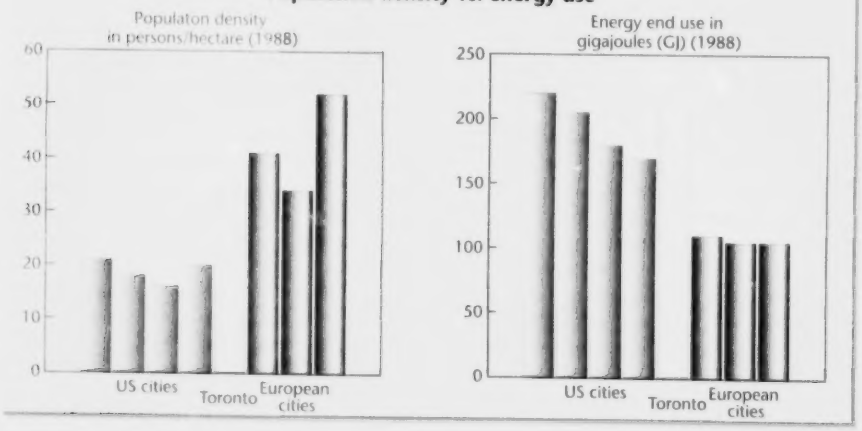
The next step is moving from understanding to action. The local government now knows what activities are the main source of emissions. Because most local governments are concerned about the cost of the energy system or the negative impact it may be having on air quality, rather than the issue of global climate change, the tools ICLEI provides convert the local government's energy data not only into GHG emissions but also into costs of energy and fuel use and the emissions of standard air pollutants. The emphasis is on motivating action: the tools and assistance ICLEI provides help the local government evaluate the beneficial impact of the variety of measures it has at its disposal. The local government can then choose actions that result in a variety of benefits, whether reducing the cost of electricity bills, improving air quality, or converting landfill methane into a saleable commodity.

The initial focus of ICLEI's work was on cities in Annex 1 countries, where the majority of greenhouse gas emissions are produced. In 1998, ICLEI initiated the Climate Action Project, involving five local governments in Mexico and six in the Philippines, to test the CCP Campaign in developing countries.

Although their greenhouse gas emissions per capita are still quite low, the CCP strategic approach is appropriate for cities in rapidly growing, industrializing economies, both to address the immediate problems of serious air pollution and inefficient energy systems and to reverse "business as usual" scenarios projected to produce substantial emissions growth.

The rapid growth rate in infrastructure and other development that characterizes cities in developing countries presents a precious opportunity to plan for and build in energy efficiency and environmental sustainability that would be

Figure 2
Population density vs. energy use



Cities for Climate Protection
"Performance Milestones"

❶ Conduct an energy and emissions inventory and forecast: a base-year inventory of energy use and GHG emissions, and an estimation of growth for a projected year, typically 2005 or 2010.

❷ Adopt an emissions reduction goal. ICLEI encourages participants in Annex 1 countries to adopt the "Toronto target" to reduce GHG emissions by 20% from 1990 levels by the year 2005 or 2010. Cities in non-Annex 1 countries are encouraged to choose a goal appropriate to local conditions, such as stabilizing per capita emissions.

❸ Develop a Local Action Plan. The Local Action Plan contains the policies and measures that, implemented, will achieve the emissions reduction goal.

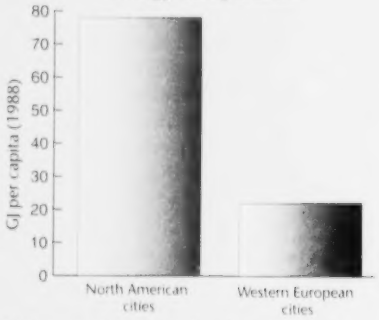
❹ Implement policies and measures. This can be a first step, since the local government may choose to start implementing emissions reduction measures before completing the Local Action Plan.

❺ Monitor and verify results. The final step is to monitor and verify progress on the implementation of actions and to quantify emissions reductions.

much more costly to put in place later. Decisions that local governments make about land use, transportation, building construction, infrastructure investment, and industrial and urban development will either mitigate or exacerbate global warming, air pollution and other urban problems. Applied comprehensively, ICLEI's model can improve urban energy management in a manner that reduces energy demand, energy costs and the negative impacts associated with energy use, while expanding the use of clean energy sources.

The analysis and planning undertaken by cities as they move through the CCP's milestone process will help get the "energy system" right. Research indicates that when cities plan and develop with energy efficiency in mind, per capita energy consumption for residential and transportation needs can be cut by several tens of per cent from typical levels. Initial build-in or inclusion of technologies for clean energy, energy efficiency and low GHG emissions comes at a much lower cost than that required to retrofit such systems and technologies later. The rate of development and the enormity of infrastructure investments in developing country cities provide an even stronger rationale for employing the type of methodology embodied in the CCP's Five Milestone Framework.

Figure 3
Per capita transport energy comparison



High automobile use in US cities results in per capita energy use from transport almost four times greater than that in European cities.

Urban climate protection in action

ICLEI has developed a standardized methodology for completing the Five Milestones and for monitoring, measuring and reporting municipalities' emissions reduction performance. This protocol is embedded in the CCP Greenhouse Gas Emissions Software developed by Torrie Smith Associates, currently used by 150 local governments in Australia, Canada, Mexico, the Philippines and the United States.

The CCP software facilitates the emissions analysis process; estimates the potential benefits of proposed emissions reduction measures; and tracks reductions of GHG emissions, air pollutants, cost savings and other co-benefits of specific actions. The software converts energy and waste data into both GHG and standard air pollutant emissions, as well as estimating potential reductions that could result from implementing specific energy efficiency, fuel-switching, waste reduction or other measures (Figure 4).

The examples that follow illustrate the CCP methodology in practice. With the exception of the European example, the emissions inventories and quantification of emissions reductions from measures were calculated using the CCP software.

United States

The Cities for Climate Protection Campaign has been active in the United States since 1995. Seventy-two cities and counties, representing 10% of total US greenhouse gas emissions, now participate.

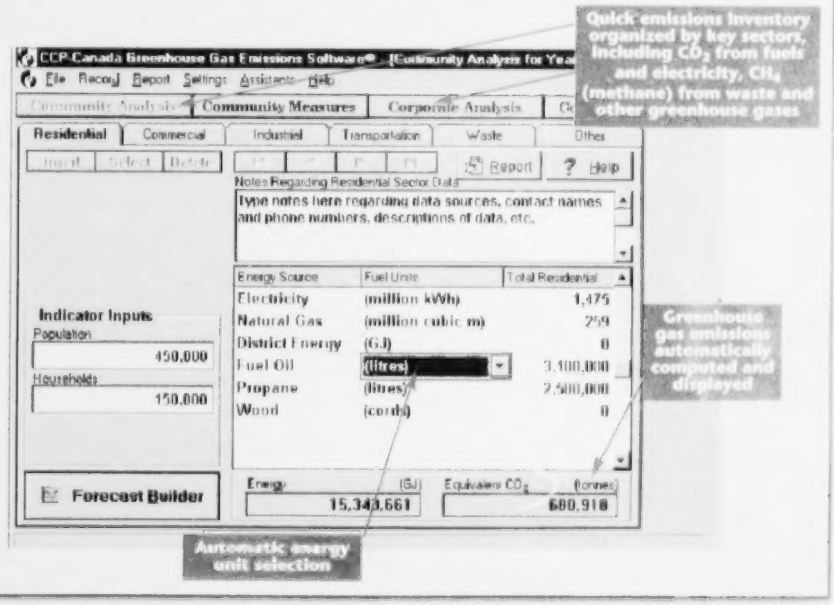
Portland, Oregon's local government participated in the CCP's predecessor, the Urban CO_2 Reduction Project. Portland was the first US city to adopt a local strategy to cut global warming emissions. It identified transportation and building energy use as the primary sources of emissions and set a community-wide reduction target of 20% below 1990 levels by 2010.

Measures being implemented as part of Portland's Local Action Plan include:

◆ City Energy Challenge Programme: energy efficiency retrofits for municipal buildings, and the efficient design of new municipal buildings and facilities.
- 9.5 million kWh of electricity reduced
- $1.3 million saved by the city in reduced energy expenditures
- CO_2 emissions reduction = 4269 tonnes[2]

◆ Renewable Energy Power Purchase: Portland developed a contract with an electric utility to guarantee 5% of electricity would be produced by new wind power sources.
- 4 million kWh switched to wind power
- CO_2 emissions reduction = 1863 tonnes

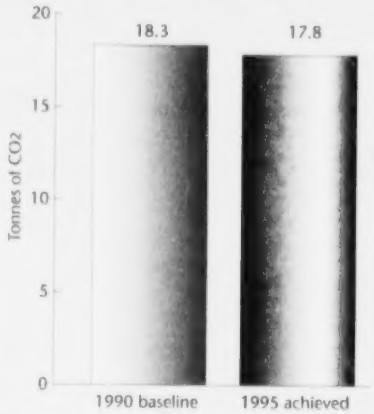
Figure 4
CCP Greenhouse Gas Emissions Software



- Residential Home and Multi-unit Weatherization Programme: provides energy efficiency services to homes and apartment dwellers.
- 19,030 households have received energy efficiency improvements
- $2.5 million saved in reduced energy expenses over the past 10 years
- CO_2 emissions reduction = 10,970 tonnes
- Partners for Energy Efficiency: provides technical assistance, incentives and tax credits for energy conservation measures in commercial buildings.
- 436,193 million BTU reduced
- CO_2 emissions reduction = 38,385 tonnes
- Fuel Cell for Electricity Generation: Methane from a waste water treatment plant powers a hydrogen fuel cell to generate electricity. The 200 kW fuel cell uses 20% of the treatment plant's methane and produces enough power to eliminate the need for the facility's back-up generator.
- 1,960,000 kWh saved
- $78,460 saved in reduced electricity expenses
- CO_2 emissions reduction = 882 tonnes
- Change in Land Use Policies: 2500 new housing units per year in the downtown area have reduced the length and number of vehicle trips.
- 2.8 million vehicle miles traveled (VMT) eliminated
- 137,958 gallons of gasoline saved
- $179,346 saved in reduced fuel expenses
- CO_2 emissions reduction = 1,380 tonnes
- Recycling: The Portland metropolitan area now recycles 53% of all solid waste, up from 26% in 1988. Its recycling goal is 60% by 2005.

As of 1995, Portland's actions had reduced per capita emissions 3% below 1990 levels, and had decreased emissions from the city's local government operations to more than 15% below 1990 levels (Figure 5).

Figure 5
Per capita CO_2 emissions in Portland



Actions implemented by the city of Portland, Oregon, reduced per capita CO_2 emissions by 3% compared with the 1990 baseline

Australia

Since the Cities for Climate Protection Campaign began in Australia in late 1998, 88 local governments (representing over 40% of Australia's population) have taken up the challenge. The campaign's target is to recruit 200 local governments (representing half the country's population) by 2003.

The City of Brisbane in Queensland is the largest local government in Australia. Brisbane's baseline emissions inventory showed that 70% of the 1.02 million metric tonnes of GHG emissions produced by city government operations came from methane emanating from the Brisbane's landfill sites and waste water treatment plants, 23% from electricity consumption and the remainder from vehicle use.

The draft action plan, underpinned by a community survey indicating that two-thirds of Brisbane's population was concerned about climate change, led the Brisbane City Council to adopt the goal of reducing greenhouse gas emissions from their municipal operations 20% below 1990 levels by 2003.

A priority area is to capture and use landfill and sewage gas for energy production. This builds on the success of Brisbane's Luggage Point sewage treatment plant, where methane is being converted into electricity – offsetting approximately 5% of municipal consumption. Brisbane has a landfill gas project which is using recovered gas to heat a municipal swimming pool. In 1999, these initiatives saved the city more than US $1 million in electricity costs and cut CO_2 emissions[3] by approximately 12,000 tonnes.

Electricity use in Brisbane's municipal facilities amounts to almost 225 GWh, costing $A 16 million per year and producing 250,000 tonnes of CO_2 emissions. An energy performance contract covering three major buildings, including the City Hall, has cut electricity consumption by 2 GWh. The city's primary strategy for reducing motor vehicle emissions is to convert its fleet of more than 600 buses to compressed natural gas (CNG).

Figure 6
Copenhagen's Local Action Plan targets (1990-2005)

Measures	CO_2 reduction target (tonnes)	% reduction
Combined heat and power	570,000	11%
Natural gas substitution	260,000	5%
Energy advisory services	290,000	6%
Waste management	400,000	8%
Transportation	(25,000)	(1%)
Other	7410	<1%
Total	**1,502,410**	**30%**

Europe

Overall, 102 local governments throughout Europe participate in the Cities for Climate Protection Campaign. Over 30 of them have reached Milestone 5 and are in the process of monitoring and verifying the outcomes of their local action plans.

Many of the European CCP municipalities are meeting their emission reduction targets through switching to cleaner or renewable fuel sources of electricity, installing energy efficiency measures in buildings, and implementing district heating systems.

Copenhagen, which was an original participant in ICLEI's Urban CO_2 Project, set a GHG reduction target of 30% by 2005 with 1990 as the base year. Coal was then the primary fuel used in generating electricity and heat, making that end-use responsible for 63% of the city's GHG emissions.

Copenhagen owns and operates its own energy supply, giving it the power to modify the energy supply infrastructure in order to improve energy efficiency and cut emissions. Two of the six main areas of action in Copenhagen's Local Action Plan reduce reliance on coal as a fuel source, for a projected reduction of 830,000 tonnes of CO_2 and the corollary reduction in standard air pollutants (Figure 6).

Measures in Copenhagen's action plan include:

• Combined heat and power

Expansion of the district heating system to cover 95% of the city's heating needs. The city used its regulatory authority to mandate compulsory connection to the system and prohibited installation of electric heating in new buildings. This measure accounts for about one-third of its CO_2 reduction target (570,000 tonnes).

• Substitution of natural gas for coal

Copenhagen determined that most of its coal-fired boilers could be modified to burn natural gas, and that new natural gas generating stations were less expensive than coal-burning counterparts. The policy aims to triple the use of natural gas for power generation, resulting in a 5% reduction in CO_2 emissions (260,000 tonnes) and cleaner air.

• Waste management

By 1995, Copenhagen had met its goals of recycling or composting 58% of household, commercial and industrial waste. As a result, 400,000 tonnes of CO_2 emissions were cut, an 8% reduction compared with 1990.

• Commercial and residential energy services

The City Lighting Department offers proactive educational and technical services that include energy audits and information about energy-saving appliances and practices for all consumers. These services are expected to reduce CO_2 emissions by 290,000 tonnes by 2005.

The Philippines

Six local governments in the Philippines partici-

pate in the CCP. In developing action plans, these cities prioritized measures that would provide cost savings and that could build community awareness of related environmental benefits. After completing the baseline emissions analysis, Naga City found that 37% of emissions from its municipal operations were attributable to its vehicle fleet, 26% to street lights, 23% to building energy use, and 14% to water and sewerage systems. The city then identified the following projects for the first phase of its action plan:

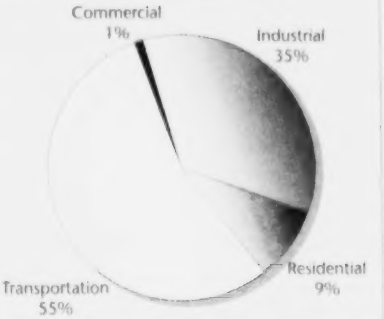
- waste segregation for garbage collection;
- switching from motor vehicles to bicycles;
- converting street lights to higher efficiency bulbs;
- waste reduction policies;
- increasing trees and green space;
- improved urban planning to integrate housing, services and transportation;
- energy efficiency retrofit for City Hall.

For its first project, Naga City intends to convert mercury vapour lamps in 10,000 street lights to energy-efficient sodium vapour lamps, reducing the city's electricity bill by 20% and its CO_2 emissions by 57 tonnes.

Mexico

ICLEI began its work with five cities in Mexico in 1998. The participants (Mexico City, Cuajimalpa, Queretaro, San Luis Potosi and Tlalpan) found that the emissions inventory and CCP milestone process facilitated strategic decision-making and encouraged them to take a multi-sector approach.

Figure 7
Results of community emissions inventory in Queretaro, Mexico (baseline year 1998)



The city of Queretaro's community-wide baseline inventory showed 2.3 million tonnes of GHG emissions (Figure 7).

Beginning the action plan process, Queretaro identified 13 potential emissions reductions measures, including replacing water pumping equipment, increasing energy efficiency in all municipal buildings, synchronizing traffic signals, preserving green space, and environmental education to motivate household behaviour changes. In view of the immediate cost savings that could be realized, Queretaro started implementation of three projects prior to action plan completion. The projects Queretaro has under way, along with the projected results are:

- **Street light conversion**

Replacement of 8000 250-watt lamps with 150-watt lamps, and of 2000 150-watt lamps with 70-watt lamps, will reduce energy consumption by 4268 MWh/year, save the city approximately US$ 447,000 in electricity costs, and cut CO_2 emissions by 3930 tonnes.

- **Fuel conversion of municipal fleet vehicles**

Switching 73 police vehicles from gasoline to liquid propane gas (LPG) is expected to reduce CO_2/year by 207 tonnes, saving the city approximately US$ 143,000/year.

- **Recycling**

Queretaro plans to implement residential separation of plastic, glass, aluminum, paper and iron for pick-up and recycling, resulting in a 2524 tonne eCO_2 emissions reduction and saving US$ 100,574/year.

Conclusion

The results of both the research conducted by the initial Urban CO_2 Reduction Project and the subsequent actions of the local governments in the Cities for Climate Protection Campaign confirm the vital role local governments have to play in response to the threat of global climate change. From the point of view of the health and economic vibrancy of an urban area, acting to protect the climate through implementing effective and environmentally sustainable energy management is immediately beneficial to any and all local governments.

The International Council for Local Environmental Initiatives (ICLEI): the international environmental agency for local governments

ICLEI is an association of local governments dedicated to preventing and solving local, regional and global environmental problems through local action. Its mission is to build and support a worldwide movement of local governments to achieve tangible improvements in global environmental and sustainable development conditions through cumulative local action. More than 350 cities, towns and counties and their associations worldwide comprise ICLEI's membership. They and hundreds of other local governments are engaged in ICLEI's regional projects and international campaigns. ICLEI serves these municipalities as an information clearing house on sustainable development. It provides policy guidance, training and technical assistance, and consulting services to increase local capacity.

Through its three international campaigns, ICLEI generates the policy commitment of participating municipal councils to address regional and global environmental challenges while building local capacity to address these challenges.

The Cities for Climate Protection™ Campaign (CCP) is a global campaign to reduce emissions that cause global warming and air pollution. Since 1993, it has engaged in this effort more than 385 local governments, which account for approximately 7% of global greenhouse gas emissions.

The Local Agenda 21 (LA21) Campaign, initiated by ICLEI in 1992, seeks to generate tangible results and increase standards of local performance through instituting broad-based participatory planning processes aimed at achieving sustainable development. It is estimated that over 3000 communities worldwide have undertaken an LA21 planning process.

The Water Campaign, launched in June 2000, at Global Cities21®, ICLEI World Congress of Local Governments, provides local governments with a supportive framework to address their unique local water management concerns while helping the current global water crisis. Regional projects focus on diverse priorities and needs. They include environmental budgeting, eco-procurement and environmental management systems.

Through its Members, ICLEI represents a substantial local government voice in regional and international deliberations on sustainable development. Since its establishment, ICLEI has worked continuously to bring the voice of local government before national and international agencies. As a result of its efforts, delegations of local government have presented their concerns and successes to annual meetings of the UN Commission on Sustainable Development and to key meetings of the Conference of the Parties to the UN Framework Convention on Climate Change.

ICLEI also has helped represent local government at the UN Centre for Human Settlements (UNCHS) Habitat II, City Summit. In 1999, ICLEI, UNCHS and UNEP jointly authored a memorandum of understanding by which ICLEI will serve as a bridge linking local government actions to the global programmes of these international bodies.

ICLEI Offices Worldwide are located in Toronto, Canada; Freiburg, Germany; Tokyo, Japan; Berkeley, California, USA; Harare, Zimbabwe; Melbourne, Australia; and Santiago, Chile.

For more information about ongoing activities, visit the ICLEI website: *http://www.iclei.org*. Or contact the ICLEI World Secretariat, City Hall, 16th Floor, West Tower, Toronto, Ontario M5H 2N2, Canada. Tel: +1 (416) 392-1462, Fax: +1 (416) 392-1478, E-mail: *iclei@iclei.org*.

From the operation of water and sewerage infrastructure, to the construction and maintenance of roads and transit systems, to the planning processes that determine development and settlement patterns, local governments already play a large, yet unappreciated, role in determining energy use and global greenhouse gas emissions. Working with local governments to respond to immediate needs for clean energy, efficient infrastructure, effective transportation and cleaner air, Cities for Climate Protection is helping to put in place the long-term decision-making processes and practices ultimately needed to meet the threat to our global climate.

The International Council for Local Environmental Initiatives (ICLEI), founded in 1990, is an international association of local governments dedicated to the prevention and solution of local, regional and global environmental problems through local action. The Cities for Climate Protection Campaign (CCP) and its Five Milestone Framework are registered trademarks of ICLEI.

The author would like to acknowledge the contributions of her predecessor, Phil Jessup, former Director of both the Urban CO₂ Reduction Project and the Cities for Climate Protection Campaign, who had the creative vision behind ICLEI's urban climate protection efforts and whose writings, together with those of Ralph Torrie of Torrie, Smith Associates, contributed to this piece. She would also like to thank Kathleen Vickery for her research and for pulling together the contributions from CCP staff in ICLEI's regional offices.

Notes

1. Since CO_2 and methane are the principal GHG emissions globally and in urban areas, the Climate Protection Campaign's methodology targets and measures these two emissions. In this article, references to GHG emissions in the context of the CCP therefore refer to CO_2 and methane.
2. Tonnes in this example are US or "short" tonnes. Quantification citations for all other examples are metric tonnes.
3. For quantification purposes, methane emissions are converted to "equivalent CO_2" or eCO_2.

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Building networks of energy-efficient cities: some practical experiences in Europe and Brazil

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Energy policy today has to combine initiatives directed at both energy supply and energy demand. A new energy policy, based on management of energy consumption and increasing use of local (renewable) energy resources, has become necessary due to the growing pressure of environmental constraints and energy-saving behaviour since the oil price crises. The local and regional levels are partners in this approach. The development of energy efficiency projects, and the exchange and spread of information on best practices among municipalities, are being organized worldwide by networks of energy-saving institutions. Several examples of the development of such networks are presented below.

An established network for building local government capacity for sustainable development is the *International Council for Local Environmental Initiatives (ICLEI)*.

The *European Commission* is drawing on three networks of local authorities: *Energie-Cités* (for municipalities), *Fédarene*, the European Federation of Regional Energy Agencies (for regions) and *Islenet* (for islands). These networks' role is to:

- distribute information;
- assist in forming partnerships to draw up proposals;
- distribute results;
- encourage exchange of experience and know-how among local authorities in Europe; and
- make proposals and express opinions on European Commission proposals.

About 170 local, regional and island energy agencies have been supported by the EC. Sixty-four were local agencies sponsored by municipalities. There are Local Energy Management Agencies belonging to the Energie-Cités network in Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Spain, the Netherlands and the United Kingdom.

The EC, as part of SAVE II, provides financial assistance with setting up local or regional teams in municipalities and regions. To encourage exchange of experience and transfer of know-how, local authorities are required to network with other authorities. The programme is open to EU Member and associated States.

In *Eastern Europe*, institutional energy-saving capacity building at the local level started as part of system transition. An impressive example is the *Center for Energy Efficiency EnEffect*, established at Sofia in 1992 to improve energy efficiency and support the efforts of central and local authorities in Bulgaria to attain sustainable development. EnEffect was founded with initial financial support from Battelle/Pacific Northwest Laboratory in the US, in collaboration with the US Environmental Protection Agency, US Department of Energy and US Agency for International Development. EnEffect belongs to national and international networks. On the national level it is the executing agency of the Municipal Energy Efficiency Network, which in 1999 consisted of 26 Bulgarian municipalities working in close collaboration with Energie-Cités on reduction of energy costs. The international network of energy efficiency centres in Eastern Europe consists of: the *Polish Energy Efficiency Foundation (FEWE)*, with branch offices in Katowize, Krakow and Warsaw; the *Czech Centre for Energy Efficiency (SEVEn)* in Prague; the *Russian Centre for Energy Efficiency (CENEf)* in Moscow; and the *Centre for Energy Efficiency of Ukraine (ArenaECO)* in Kiev. Also participating in this network is the *Chinese Centre for Energy Efficiency and Renewable Energy Sources (BECon)* in Beijing. The new centres exert influence on the energy policies of their respective countries and assist technology transfer and exchange of information for both supply- and demand-side energy efficiency improvements, mainly at the local level.

Local Sustainability was launched at the 2nd European Conference on Sustainable Cities and Towns in Lisbon on 6 October 1996. Three key services cover good practice guidance, examples, and policy documents on sustainability and the urban environment. For Local Sustainability, the *European Good Practice Information Service* is developed and operated by EURONET Environment Planning and Development and ICLEI, with financial support from the EU.

The searchable *Best Practices database* contains over 650 proven solutions to common social, economic and environmental problems in an urbanizing world. This database, a joint product of UNCHS (Habitat), the Dubai Municipality and the Together Foundation, has been made possible with support from the Best Practices Partners and the governments of Spain, Switzerland and the UK.

The *Climate Alliance of European Cities with Indigenous Rainforest Peoples* is a network of European local authorities and indigenous rainforest peoples, whose goal is protecting the Earth's atmosphere. In January 2000, nearly 900 European member cities worked jointly on drawing up and implementing climate protection action plans and cooperated with the partners to preserve tropical rainforests. Climate Alliance members are located in Austria (209), Belgium (7), Denmark (5), Germany (403), Italy (58), Luxembourg (13), the Netherlands (107), Spain (2), Sweden (3) and Switzerland (12). There are 38 associated members. An example of this network's approach concerns the Swedish town of Växjö (70,100 inhabitants), which has decided to stop use of fossil fuels by the municipality and to reduce CO_2 emissions by 50% by 2010. The decision to stop using fossil fuels resulted from Local Agenda 21 work. Several local companies have praised this decision. Växjö has managed a decrease of almost 20% of CO_2 emissions per inhabitant since 1993, mainly related to the heating sector.

Networking of municipalities to save energy costs also has a foothold in Latin America. In October 1998, the *Network of Energy Efficient Cities* was launched in Brazil as an ELETROBRÁS initiative. Its purpose is to persuade municipalities to implement "Municipal Energy Management" (Gestão Energética Municipal, or GEM) in order to reduce energy waste in areas such as public illumination, sanitation and buildings. At the end of 1999, approximately 265 municipalities in Brazil had joined the network, with the aim of facilitating the exchange and spread of information on the development of electric power efficiency projects among both Brazilian and non-Brazilian municipalities. Successful local experiences, stored in a database, will be disseminated in the form of bulletins and at network meetings.

One of the network's major activities is organizing courses on subjects related to municipal energy management. They include talks to raise technical staff's awareness of the problem. One of the benefits for towns integrated in the network is the possibility of reducing electric power bills through implementing procedures that inhibit energy waste. The network wants to foster technical co-operation, as well as national and international agreements, with a view to improving energy-efficient management and activities.

The establishment of well functioning and innovative networks of energy efficiency institutions on the central and regional/local levels has been going on for over a decade. The initiatives of cities concerned with energy-saving and renewable energy sources play a crucial role in this process. However, these networks require stabilization and extension, for example in regard to education and awareness raising.

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Intelligent building = green building

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Abstract

Over the past decade, the term "intelligent building" has been used extensively to describe new high-tech buildings. This term has been quite popular in Asia, where many of the largest new building construction projects have taken place. The intelligent building concept naturally links to environmentally friendly "green buildings". This article includes a description of the Brengel Technology Center, one of the first 12 buildings certified under the US Green Building Council LEED (Leadership in Energy and Environmental Design) Green Building Rating System™.

Résumé

Depuis une dizaine d'années, on parle souvent de "bâtiments intelligents" pour décrire les nouvelles constructions high-tech, notamment en Asie où ont été réalisés la plupart des plus gros projets récents de construction. Le concept de bâtiment intelligent est lié tout naturellement à la notion de "bâtiments verts", respectueux de l'environnement. L'article présente entre autres le Brengel Technology Center, l'un des 12 premiers bâtiments a avoir reçu le label LEED (Leadership in Energy and Environmental Design) décerné par le US Green Building Council selon son système de notation baptisé "Green Building Rating Systemô".

Resumen

Durante la última década, el término «edificio inteligente» se ha aplicado en particular a aquéllos dotados de la más alta tecnología. El vocablo se ha hecho muy popular en Asia, donde se han erigido muchos de los mayores proyectos de edificación actuales. El concepto de edificio inteligente está naturalmente vinculado al de «edificio verde», respetuoso del medio ambiente. El presente artículo ofrece una descripción del Brengel Technology Center, una de las 12 primeras construcciones premiadas con el galardón LEED (Líder en energía y diseño ecológico) del Consejo Estadounidense de Construcción, según el Sistema de clasificación de edificios verdes (Green Building Rating Systemô).

Definition of an "intelligent building"

The definition of an "intelligent building" has been controversial since the term was coined 15 years ago. It was first used in the United States to describe buildings offering shared tenant services, such as long distance access, through a common PABX.

NTT, the Japanese telephone giant, used a three circle model to describe an intelligent building (IB) (Figure 1). This model implies that integration of the telecommunications, office automation and Building Automation Systems make the building intelligent.

The European Intelligent Building Group (EIBG) produced a triangular model of an Intelligent Building with a "Computer Integrated Building" at the apex, supported by Building Automation and an Integrated Communications System (text, voice, data, image, etc.).

In the US, the Intelligent Building Institute (IBI) created another intelligent building model (Figure 2).

In Malaysia, the Kuala Lumpur city hall issued "Intelligent Building Guidelines" which assigned a star rating (similar to hotels). These guidelines did not mention office automation or telecommunications, but addressed many architectural issues (height of lobby, etc.).

A survey conducted by Singapore's Construction Industry Development Board (CIDB) showed that some industry professionals would go to mechanical and electrical consultants for more advice on building intelligence, while others would go to office automation specialists. In other words, there is disagreement on what constitutes an intelligent building, even within the same marketplace.

The latest development is to figure in energy efficiency when intelligent buildings are being defined. Increasingly, energy efficiency has taken on a broader meaning – it means green. In today's urban areas, with their density of population and structures, and often depleted or degraded environments, making buildings green has taken on a new urgency. Today it is high rises brewing volatile organic compounds (VOCs), rather than heavy industry factories belching smoke, that have the greatest environmental impact, simply because of their relative numbers.

I would like to introduce my own definition of intelligent buildings, which I believe encompasses all of the other definitions. My definition is "a building applying appropriate technology to satisfy owner and occupant needs."

Technology is at the heart of the intelligent building, but an intelligent building is not a monument to technology. Technology becomes obsolete in a few years, but a building is expected to last a long time. For example, today's intelligent building would make extensive use of web-based technologies – technologies which did not exist a few years ago. Building intelligence is a concept, a design issue. It is not a product.

There are two main stakeholders in the building – the owner and the occupant (Figure 3). If stakeholder needs are not reflected in the design of the intelligent building, then the concept is destined to be a short-lived fad.

Within this definition, "green" issues such as energy efficiency and a well-lighted and well-designed workplace are becoming increasingly important to building owners and occupants. That's because intelligent, green buildings mean energy savings for owners and a more comfortable, productive work environment for occupants.

In a broader context, green buildings are critical to urban areas. The high number and concentration of buildings in urban areas mean they have a significant impact on the urban environment, most notably through energy consumption but also through consumption of other resources and the use of cleaning and maintenance products.

Owner needs

Low first costs

Imagine that you buy a new 10 horsepower motor, the type commonly used in air conditioning systems. Imagine that you then run this motor 24 hours each day. How long before the electricity cost to run the motor is equal to the capital cost of buying a new one? When asked this question, most "building experts" would estimate a period of one to two years. In fact, in almost all countries the correct answer is one to two months! The message here is that even "building experts" are overly focused on first cost, rather than considering life cycle costs. The life cycle cost of a US office building over 40 years has the following components:

- 25% construction/financing costs;
- 25% energy costs;
- 25% operations and maintenance costs;
- 25% retrofit costs.

Low operating and maintenance costs

Increasingly, professional building managers are trying to standardize procedures and are turning to computers as a tool. For example, an integrated Building Automation System provides a computerized platform to accommodate standardized:

- equipment monitoring;
- information recording;
- equipment control;
- information reporting.

Low energy consumption

Lowering energy consumption impacts more than just energy costs. In the US, the State of Wisconsin recently embarked on a Wisconsin Energy Initiative (WEI). WEI brought the state significant financial and energy savings and reduced pollution. Wisconsin saved more than US$ 10 million through better prices, reduced energy use, and utility rebates. State energy demand has been reduced by 20 MW and energy consumption is down by 61 GWh annually. WEI has eliminated 55,000 tonnes of CO_2, 669 tonnes of SO_2 and 235 tonnes of NO_x emissions. More than 600,000 used fluorescent light bulbs and 1 million pounds of PCB ballasts have been recycled.

According to the on-line Cleaner and Greener℠ "Pollution from Electricity Use" Calculator from the Leonardo Academy (*http://www.cleanerandgreener.org/pollution-from-electricity.htm*), a commercial building in New York that spends US$ 10,000 per month for electricity generates the following annual pollution:

- 1,068,960 pounds of greenhouse gases (CO_2);
- 15 pounds of volatile organic compounds (VOCs);
- 1445 pounds of nitrogen oxides (NO_x);
- 103 pounds of carbon monoxide (CO);
- 3818 pounds of sulphur dioxide (SO_2);
- 33 pounds of particulates (PM_{10});
- 11,710 mg of mercury;
- 2374 mg of cadmium;
- 28,316 mg of lead.

To save energy in a building, it is important to focus on the major energy consuming devices and systems. In most buildings, the Heating, Ventilating and Air Conditioning (HVAC) system uses more than half the building's energy. Together, the HVAC and lighting systems consume more than three quarters of the energy in a typical office building (Figure 4).

Today's commercial buildings are typically equipped with a Building Automation System which controls the HVAC and lighting to reduce energy. Lifts/elevators come equipped with their own energy-efficient controls.

Figure 1
NTT model of an intelligent building

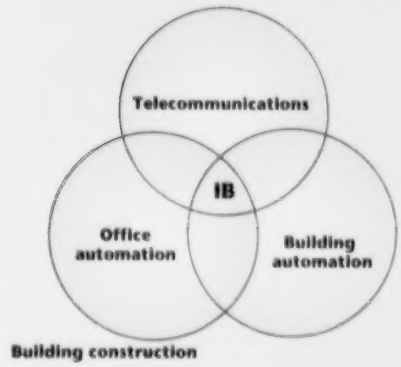


Figure 2
IBI model of an intelligent building

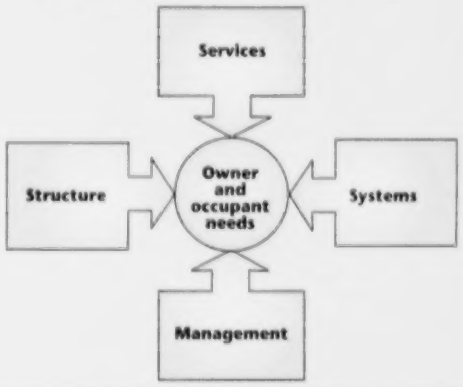


Figure 3
Relationship between IB and "green" issues

	Owner needs	Occupant needs
	Low first cost	Quality environment
	Low operations and maintenace cost	Flexibility to adapt to changing needs
"Green" issues	Low energy consumption	Support corporate mission

Occupant needs

A quality building environment

Building occupants want a quality building environment to enhance productivity (Figure 5). A 1995 White House report suggests that, in the US, better constructed facilities could increase employee productivity and comfort up to 30% nation-wide. The Office of Science and Technology Policy released the report.

In a paper presented at the Indoor Air '96 Conference in Japan, Dr. David Wyon of Johnson Controls showed how individual adjustment of the thermal climate to take account of different personal requirements can improve *group average performance* of office tasks. The expected improvements were in the range of 2-10%, depending on the task.

"Total labour-related costs per square foot of office space are typically over 100 times greater than the costs of regulating temperature and maintaining the building," says Dr. Wyon. "If these operational costs were doubled to achieve a quality building environment, they would pay for themselves with only a 1% improvement in occupant productivity. A quality building environment does not have to be costly, but it does have to be better thought out and better maintained."

Comfort involves more than temperature. Other factors, such as lighting and acoustics, also affect how comfortable an employee is in the workplace. Studies have shown that effective ventilation, adequate lighting, good acoustics and superior indoor air quality can increase productivity by 6-16%.

Flexibility

The facility infrastructure must deliver five services to the desktop: air conditioning, lighting, power, data and telephones. The intelligent building must also be able to deliver these services when they are required (time flexibility) and how they are required (space flexibility).

In the future, the occupancy pattern of buildings will be changed due to:

- increasing use of "flex-hours" to reduce traffic congestion;
- shifting demographics in the workplace, from clerical to knowledge workers;
- globalization, requiring extended support and video conferencing.

As shown in Figure 6, the amount of time a building will operate at partial occupancy will increase dramatically.

This situation raises some interesting issues that had received little attention in previous building design:

- providing effective security in a partially occupied building;
- providing an effective fire detection and prevention system and effectively managing an evacuation of a partially occupied building;
- ensuring that air conditioning and lighting are only applied when required, to minimize energy use.

To meet these challenges, the intelligent building must be designed with many zones and the Building Automation System must be able to control the systems for each zone. The occupancy status of a zone (occupied/unoccupied) can be determined according to time schedules, occupancy sensors, card readers, door lock indicators, or triggered using the telephone or PC. When the Building Automation System of an intelligent building is aware that a zone is occupied, it can automatically:

- set the sensitivity of smoke detectors to low, in order to avoid unwanted alarms;
- inhibit alarm reporting for selected security devices in the zone;
- change temperature setpoints to the occupied level;
- set ventilation requirements to the occupied level;
- turn on the lights in the zone.

An intelligent building must be able to accommodate a changing usage pattern for the space. It must also be able to accommodate dramatic shifts in how the space is used.

According to a 1995 survey conducted by the International Facility Management Association (IFMA) Foundation and Haworth, 83% of companies are participating in alternative-office strategies such as modular workspaces, telecom-

muting, flexible work schedules and hotelling – which one firm describes as "just-in-time offices." When IBM announced that it has saved more than *US $1 billion* in real estate expenses through shared office space, corporate America began to take notice.

From today's vantage point, it is a safe bet that corporations will be in a state of continuous reorganization. They will demand building products that are compatible with reconfigurable architecture systems, are expandable when necessary, and can be modified by the end-user.

Office equipment manufacturers are meeting the flexibility challenge with innovative "plug-and-play" workspace designs. It is now possible for individuals to wheel their personal workspaces – and all the technology they use, such as computers and telephones – into common areas for team meetings. They can drop in or out of meetings easily just by wheeling back to where they came from. In this way, corporations avoid the costly and time-consuming rearrangement of office space to meet the changing needs of the company.

In an April 1996 cover story, *Business Week* quoted a Vice President at Procter & Gamble who predicted that innovations like these should help increase productivity by 20-30% at a new P&G facility devoted to product development. The executive said the facility was designed and built "as if we were developing a new product."

Figure 4
Energy use in a typical office building

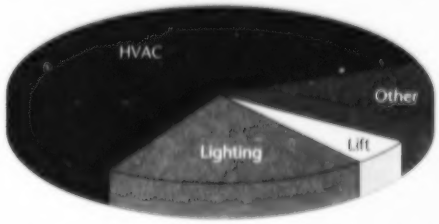


Figure 5
Factors affecting quality building environment

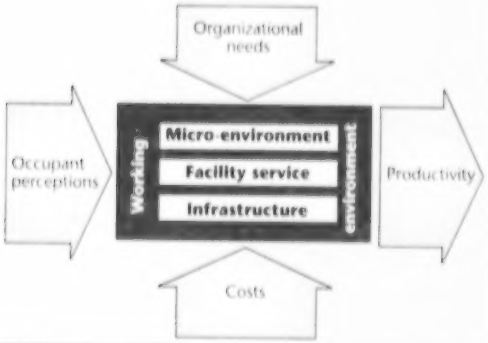
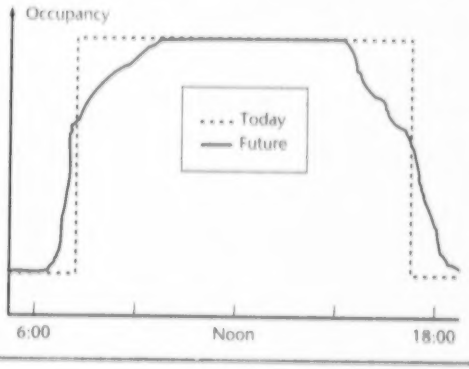


Figure 6
Changing occupancy patterns in buildings



Supporting the corporate mission

"A facility is not just a place to go to work – it's a place that determines how productive employees will be and how they perceive their company," says Shari Epstein, a research specialist at the International Facility Management Association (IFMA).

There is increasing awareness that a company's facilities must reflect and support their corporate mission. Increasingly, corporate missions are reflecting concern about the environment. Many organizations want their buildings to act as a showcase of this concern. As described in the box, the US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ allows recognition of such facilities.

Case study: Brengel Technology Center

The US$ 25 million Brengel Technology Center, with 130,000 square feet, was built by Johnson Controls in Milwaukee, Wisconsin. The seven-storey facility is a showcase for Johnson Controls' advanced building controls technology and expertise in creating quality building environments. Johnson Controls, a building systems and energy efficiency expert, is helping customers save US$ 18 billion in energy costs during the next decade while reducing air pollution by 352 million tonnes.

The new building complements the original building right next door, which was built in the early 1900s and was the first home of what was then Johnson Service Company. It is named for Fred L. Brengel, the fifth executive to head Wisconsin's largest publicly held company, which now has sales exceeding US$ 16 billion annually. Dedicated on 21 March 2000, the building will be fully occupied by the summer.

Unique sustainable features

- An open courtyard offers green area in the middle of a major city's downtown;
- Personal Environments™ systems give employees desktop control of temperature, lighting, airflow and background noise masking;
- This new building in the city centre mirrors the architecture of the original adjacent headquarters, which is still in use. Employees who bus or bicycle to work are accommodated, with showers available;
- Each employee has the ability to communicate the building's environmental conditions from his or her desktop computer;
- The Building Automation System optimizes the efficiency and performance of the building's mechanical and electrical systems, with remote access to any activity from turning off lights to starting the air conditioning;
- A roof-mounted weather station helps improve the accuracy of energy applications by forecasting system load;
- Utility services use energy sub-metering, load profiling and cost report generation to better identify savings opportunities;
- Advanced lighting technology complements the abundant natural light.

Other features

- The interior design easily accommodates reconfiguration of employee workstation areas to foster new ways of working;
- Open ceilings with painted ductwork throughout the building allow visitors to see Johnson Controls products in use;
- A single cabling network integrates voice, data, video and controls systems;
- Access and security systems ensure safety.

The Brengel Technology Center was one of the first 12 buildings certified under the US Green Building Council LEED Green Building Rating System™.

Rob Mault has been involved with intelligent buildings for 15 years.

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Urban environmental management

LEED builds performance inside and outside

Breakthroughs in building science, technology and operations are available to designers, builders and owners who want to build green: maximizing both economic *and* environmental performance.

The US Green Building Council offers a leading edge system for designing, constructing and certifying the best buildings on the planet – buildings as good economically as they are environmentally. The USGBC is a non-profit, consensus-based coalition of diverse leaders from all sectors of the building industry.

Leadership in Energy and Environmental Design, or LEED™, is a comprehensive system of building rating and certification that offers:
- well-founded scientific standards;
- up-to-date green building training;
- a professional accreditation programme;
- knowledgeable technical support;
- prime educational and internet resources.

LEED guides

The *LEED Green Building Rating System* (the complete framework of standards for setting building goals), used in concert with the *LEED Reference Guide* (a comprehensive reference tool of design and construction strategies), shows builders how to:
- maximize efficiencies in resource investment and energy use;
- achieve optimal economic and environmental performance;
- use building site, assets and materials creatively and wisely;
- be inspired by the natural environment in landscaping, material use, recycling efforts and more.

LEED encourages state-of-the-art green and sustainable strategies, focused on standard building topics such as:
- building materials;
- construction waste management;
- energy efficiency;
- indoor air quality;
- landscaping/exterior design;
- occupant comfort and health;
- renewable energy;
- ozone depletion/CFCs;
- transportation;
- water use efficiency.

Overview of the LEED process

1. Register building project;
2. Take advantage of LEED education and technical support;
3. Apply for LEED certification.

LEED certifies

At the beginning stages of a building project, the design/construction team registers with the USGBC for LEED certification. Once minimum prerequisites are satisfied, LEED awards credits for achievements in innovative, cost-effective environmental design and construction in the following areas:
- Site – site selection, native landscaping, erosion and storm water control, heat island and light pollution reduction, and location efficiency;
- Water – water efficiency and reuse, rainwater capture and use;
- Energy – efficient design, energy system commissioning, renewable energy, performance measurement and verification, elimination of harmful refrigerants, and green power;
- Materials – resource reuse, recycled content, construction waste management, use of local materials, and occupant waste recycling;
- Indoor environmental quality – thermal comfort, low VOC materials, air monitoring, contaminant control.

LEED also features innovation credits to provide flexibility in addressing regional issues, unique projects, or innovative approaches to sustainable design. When the building project is finished, project leaders submit a documented application for certification by the USGBC. LEED™ certification from the USGBC is awarded on one of four tiers:
- LEED Green Building – High level of accomplishment in sustainable design;
- LEED Green Building *Silver* – Excellence in sustainable design;
- LEED Green Building *Gold* – Outstanding sustainable design;
- LEED Green Building *Platinum* – Highest achievement in sustainable design.

LEED supports

LEED technical expertise is available to registered projects every step of the way, to ensure success in applying LEED green building standards towards LEED certification. Building project leaders have ready access to LEED technical support to answer tough questions, provide credit interpretations, and guide designers, builders and owners through the certification process.

LEED educates

The USGBC, together with other associations, present green building issues and knowledge learned through LEED. Seminars help maintain a high quality application of LEED standards. They also provide a forum for showcasing the best practices of LEED certified buildings and green buildings. Workshops and seminars are an ideal way for those starting a building project to learn more about LEED.

For more information about LEED, contact the US Green Building Council, 110 Sutter Street, Suite 410, San Francisco, California 94104. Tel: +1 (415) 445 9500; Fax: +1 (415) 445 9911; www.usgbc.org

Urban energy management initiatives in Malaysia

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Abstract

No matter what development models are followed, urban growth exerts tremendous pressures on resource use and management. Urban development based on the concept of sustainability needs to address the validity of these models, including consideration of the impacts they have already had. It can be argued that solutions to urban energy problems (e.g. energy efficiency and reduced use of fossil fuels) need to be based on economic and business principles that accommodate sustainable development.

Resumé

Quel que soient les modèles de développement adoptés, l'urbanisation exerce des pressions considérables sur l'utilisation et la gestion des ressources. Tout développement urbain basé sur le principe du développement durable doit, par conséquent, vérifier la validité de ces modèles en tenant compte notamment des impacts qu'ils ont déjà eus. On pourrait proposer que les solutions aux problèmes énergétiques en milieu urbain (par exemple le rendement énergétique et un usage réduit des combustibles fossiles) soient basées sur des principes économiques et commerciaux compatibles avec un développement durable.

Resumen

Sean cuales sean los métodos de desarrollo que se apliquen, el crecimiento urbano supone un reto importante en cuanto al uso y la gestión de recursos. Si lo que se pretende es un desarrollo urbano basado en el concepto de sostenibilidad, se debe plantear la validez de los métodos, teniendo en consideración sus repercusiones precedentes. Del mismo modo, se puede aducir que las soluciones a los problemas de recursos energéticos urbanos (como el uso eficiente de energía y la restricción de carburantes fósiles) han de basarse en fundamentos económicos y empresariales que coadyuven a un desarrollo sostenible.

A vast literature exists on the subject of urban growth and development, as well as urban environmental management. Although a few distinct urban growth patterns can be discerned, all urban areas exhibit certain common characteristics. One is the relentless growth of urban centres all over the world. Urbanization in developing countries is occurring at a very fast pace. Another characteristic is the heavy demand for energy resources to use in transport, lighting, heating, cooking, cooling and industrial applications. The observed trend of this demand for energy has shown a continuing increase.

It has become evident that the amount of hydrocarbons from burning of fossil fuels has been increasing. The highest rate of growth is in urban areas, corresponding to increases in the number of vehicles, industrial facilities and commercial areas as well to habits of over-consumption.

Producing energy from renewable sources has become a much heralded objective, but the amount forthcoming is still very short of the energy consumed by the urban metropolis with its commercial centres, industrial estates, residential conurbations and urban sprawl.

The engine of urban growth is capitalism and commercialism. The fuel for this engine is private gain. The irony of the situation is that there is a possibility that individual and cluster cell growth may be occurring at the expense of killing the main organ. Since it might be impossible to counter this pervasive and entrenched ideology, solutions to the urban energy problem may need to be based on economic and business principles that accommodate sustainable development.

Businesses plan for a number of possible alternative futures as a way to hedge risk and allow for contingencies. Urban administrations and residents should adopt similar methods to address urban energy management. Approaches such as energy efficiency, improved fuel economy and reduced use of fossil fuels can provide relatively quick results in terms of emission reductions.

The Malaysian experience

Malaysia's rapid modernization and development have greatly depended on energy, especially energy based on fossil fuels. Recently, in line with international initiatives and to fulfil its global obligations, Malaysia has embarked on reconfiguring its energy structure. Instead of a "four-fuel strategy" – coal, oil, gas and hydro – renewable energy is now included in a "five-fuel strategy". The National Energy Policy will focus on developing a more sustainable energy system. In opening the World Renewable Energy Congress in Kuala Lumpur in June 1999, the Prime Minister said that "the next five-year national development plan, the Eighth Malaysia Plan (2001-2005), will identify appropriate implementation strategies for the development and utilization of renewable energy sources as an important component of our total energy mix." He went on to say that recurring savings from energy efficiency programmes would also qualify as renewable energy.

Energy use in Malaysia

In 1996, total commercial energy consumption in Malaysia was about 24.2 Mtoe (million tonnes of oil equivalent) by the following sectors:

Industrial	39%
Transport	37%
Residential and commercial	15%
Non-energy use	7%
Agricultural	2%

The energy sources were:

Petroleum products	71.1%
Electricity	15.7%
Gas	10.2%
Coal and coke	3.0%

The following statistics from the Malaysia Energy Centre, established in mid 1998, apply to Malaysia for the year 1999.

About 85% of Malaysia's electricity was generated from non-renewable sources. With rapid annual economic growth of around 8% over 10 years, irrespective of the temporary slack during the last two years, the annual increase in peak electricity demand was 12-15%. Peak demand growth and forecast are as follows:

Year	Maximum demand (MW)
1986	3000
1997	9200
2000	11,000
2005	17,000
2020	30,000

Malaysia's electric power plant mix, with an installed generation capacity of 14,709 MW, is:

Gas	58.5%
Hydro	13.4%
Oil	13.0%
Diesel/fuel oil	7.7%
Coal	4.8%
Distillate	1.2%
Biomass	0.5%
Other	0.9%

Electric energy of 61,785 GWh is produced from the following resources:

Gas	65.6%
Oil	16.0%
Hydro	7.2%
Coal	6.7%
Diesel	3.3%
Biomass	1.0%
Distillate	0.2%

Urban environmental management

Total electric energy consumption of 52,430 GWh is by the following sectors:

Industry	51.9%
Commercial	28.4%
Domestic	18.6%
Public lighting	0.8%
Mining	0.2%
Export	0.1%

There are 5.22 million electricity consumers. They break down into the following categories:

Domestic	83.7%
Commercial	15.3%
Public Lighting	0.5%
Industry	0.4%
Mining	<0.1%

Industrial and commercial users account for over 80% of total consumption, while domestic consumers make up less than 20%. Efforts to reduce energy consumption should therefore be aimed primarily at the former to achieve the maximum effect. As they are organized business entities, a business approach would be the most attractive to them. Furthermore, the number of entities is very much smaller, enabling effective outreach programmes.

Malaysia is on course to become an industrialized country by 2020. One of the clearest signs of this is rapid urbanization. The number of new urban centres has increased, as has the sprawl of existing centres. In certain areas, metropolises are appearing with the merger of more than two urban centres (the Kuala Lumpur-Petaling Jaya-Kajang-Serdang-Bangi conurbation, the Shah Alam-Subang Jaya-Klang merger, the Johor Baru-Pasir Gudang spread). Other indicators are the increasing proportion of urban dwellers compared to rural ones and the urbanites' growing per capita incomes, the higher urban contribution to GDP, the increasing number of motor vehicles, and new road systems as well as transport modes.

Urban energy management

A corollary of this urbanization is the heavy demand on energy resources. Realizing the limited potential and drawbacks of existing energy sources, the Malaysian government is spearheading urban initiatives as outlined below to reconfigure the energy situation through focusing on renewable energy.

The Malaysian Industrial Energy Efficiency Improvement Project

The Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) has been developed in the programming context of removing barriers to energy conservation and energy efficiency in industrial sectors such as cement, ceramics, glass, pulp and paper, iron and steel, wood, food and rubber.

The rationale of this project is to reduce barriers that are economic, financial, informational, regulatory and technical in nature. Barriers to implementing energy efficiency and energy conservation (EE&EC) projects in industries include limited knowledge and awareness, together with lack of information concerning EE&EC techniques, technologies and benchmarks and life-cycle economic benefits. Producers remain extremely sensitive to the relatively high first cost of energy efficient equipment.

Implementation of the ongoing energy efficiency programme is primarily guided by the utilization objective of the National Energy Policy. In consonance with the utilization objective, a national energy efficiency strategy is currently being considered for implementation. The objective is not to constrain energy consumption, but to promote efficient use of energy resources.

Urban-centred energy facilities

Some Malaysian initiatives aimed at efficient energy use and management in an urban environment are described below.

Gas district cooling

Gas district cooling systems are gaining prominence in Malaysia. An increasing number of commercial districts are opting for this system to meet their air conditioning requirements. Since 1993, an estimated 95,000 refrigerant tonnes (RT) of district cooling system capacity has been developed.

A gas district cooling system is a centralized energy plant generating chilled water to meet the air conditioning requirements of several buildings in a district. The district cooling system uses energy more efficiently than conventional air conditioning systems, as a single system applies to a wide area and to various buildings, levels off the energy load and saves fuel. The cooling plant also has the dual function of cogenerating electricity and thermal energy, thus reducing dependence on the national electricity grid. This optimizes energy use, as urbanization is characterized by high density of buildings and people that need to be cooled within a given area (e.g. apartments, offices, commercial centres, entertainment centres, hotels, indoor stadiums, galleries and museums, restaurants, transportation terminals). District systems can cool these establishments simultaneously at minimal set-up, operational and maintenance costs.

At the plant, natural gas piped in from the source is fired to drive gas turbines, generating electricity. The heat is cogenerated to produce steam, which is used to drive chillers that cool the water. A combination of steam absorption chillers and electrical centrifugal chillers is used. Chilled water at 7°C is then piped to buildings for air conditioning. Once thermally spent, the water returns to the plant to be re-chilled. To ensure uninterrupted operation, the system is designed to run on alternative fuels such as diesel.

Apart from normal electrical wiring, the only installations required in each client building are two networks of pipes – one to supply chilled water, and the other to return the thermally spent water to the plant.

The popularity of the district cooling system is enhanced by its pollutant-free and environment-friendly features. The cooling plant uses natural gas as the main fuel, while its chillers use non-CFC based Refrigerant 134A. By concentrating a district's air-cooling and electricity-generating facilities in one building, the system minimizes air and noise pollution. Without the multiplicity of cooling towers within an area, it reduces the "cooling drift" of chemically treated water escaping from conventional cooling towers and reduces the "composite noise" and heat that is caused by many cooling towers. Quality of life in the urban areas is therefore enhanced.

The benefits of the gas district cooling system are summed up as follows:

Economies of scale
Various types of buildings such as offices, apartments, hotels restaurants and airports can be cooled simultaneously at minimal set-up, operational and maintenance costs.

Low start-up costs
The initial capital cost of individual structures for a building's air conditioning needs is eliminated. Instead, all air conditioning costs can be written off as operational expenses.

Reliability
The gas district cooling system provides a reliable, uninterrupted 24-hour supply of air conditioning and electricity, which is essential for buildings such as hotels, factories and hospitals.

Total self-sufficiency
The gas district cooling plant supplies both chilled water and electricity, making client buildings totally self-sufficient.

Manpower cost savings
Individual building owners need not employ technicians and operators as they do now to handle a conventional air conditioning system. Maintenance servicing comes as part of the district cooling package.

Space saving and aesthetic appeal
Since chillers and cooling towers are not needed in each building within a commercial district, the extra space can be used for "green lungs" or recreational purposes. This will improve the overall appearance of commercial district.

The Kuala Lumpur City Centre

The Kuala Lumpur City Centre (KLCC) is the first project in Malaysia to utilize gas district cooling for its air conditioning system. The cooling plant, with a capacity of 30,000 RT, has the following system configuration:

- three units of electrical centrifugal chillers, each with a capacity of 5000 RT;
- three units of steam turbine centrifugal chillers, each with a capacity of 5000 RT;
- two units of gas boilers, each with a capacity of 47 tonnes per hour;
- two gas turbine generating units, each with a 4 MW capacity;
- two units of gas turbine generators, each with a 50 MW capacity.

Chilled water from the district cooling plant is supplied to an estimated 6.5 million square feet (603,870 m²) of floor space in various buildings in the KLCC's North West Development area, namely:

- the 88-storey PETRONAS Twin Towers, currently the world's tallest building;
- the 50-storey Menara Maxis;
- the six-storey Suria KLCC Retail Centre;
- the 32-storey Mandarin Oriental Hotel;
- the 30-storey Menara Esso;
- the Dewan Philharmonik PETRONAS;
- the PETROSAINS (Science Exhibition Gallery);
- the Galeri PETRONAS; and
- the Permata KLCC.

Kuala Lumpur International Airport (KLIA)

In addition to cooling purposes, the airport's district cooling plant has been designed with an added emphasis on generating electricity to service KLIA facilities. About 10-15 MW of electricity will be consumed internally to produce chilled water while the remaining 25-30 MW is supplied to various premises at the airport.

Phase 1 of the district cooling plant, with a capacity of 22,500 RT, is currently operational and has the following system configuration:

- nine steam absorption chiller units, each with a capacity of 22,500 RT;
- two standby auxiliary gas boilers units, each with a capacity of 25 tonnes per hour of steam;
- two cogeneration system units, each with a capacity of 20 MW.

The district cooling plant supplies chilled water to 14 buildings within the KLIA, such as the Main Terminal Building, Administrative Building, Contact Pier, Air Traffic Control Tower, Satellite Building A, Engineering Complex and Custom Complex.

Another 7500 RT cooling capacity is installed to cater for additional demand from privatized airport facilities.

Expansion of the district cooling plant under Phase 2 is envisaged in 2012, to complement the expansion of the airport. The additional capacity to be installed is 12,500 RT. Another 20 MW cogeneration will also be installed to increase the amount of excess electricity available to airport facilities. By the year 2012, about 45 MW of electricity will be supplied to them.

To minimize the redundant steam recovered from the gas turbine exhaust, the gas turbine will be operated in accordance with the actual chilled water load demand. The electricity generated by the cogeneration system is first consumed in the plant. Only the excess electricity will be supplied to KLIA facilities. The remaining power requirement will come from the National Electricity Grid.

Putrajaya

Putrajaya, the Malaysian Federal Government's new administrative centre, is a RM20 billion mixed development project on a 4390 ha site about 60 km south of Kuala Lumpur. Besides cooling and electricity generation facilities, the cooling plant here is equipped with thermal energy storage of 18,000 RTH. This is a storage facility for chilling and storage of water at night, to take advantage of the cheaper electricity tariff between 10 p.m. and 7 a.m. Chilled water will be delivered during the day, since the demand is from offices operating in the district.

The plant's cooling capacity is 25,000 RT. The total system configuration is as follows:

- nine steam absorption chiller units, each with a capacity of 25,000 RT;
- two electrical centrifugal chiller units, each with a capacity of 1250 RT;
- one thermal energy storage unit, with a capacity of 18,000 RTH;
- four auxiliary gas boiler units, each with a capacity of 22.5 tonnes per hour of steam;
- three cogeneration units, each with a capacity of 4.4 MW.

The prospects for implementing more gas district cooling systems are good, as more property owners, developers and managers realize the benefits of using an environmentally friendly and energy-efficient system for air conditioning. With abundant availability of natural gas, the cogeneration system is also a viable back-up to conventional electrical systems.

The above facilities are undertaken by a company, Gas District Cooling Sdn. Bhd.

Waste to energy

Pasir Gudang is the primary shipping terminal in the south of Peninsular Malaysia, located on the southern tip of the state of Johor on the Straits of Johor. Recently a second facility, the Port of Tanjong Pelepas, was established in the southwestern part of Johor. Also at Pasir Gudang is the well developed satellite town of Johor Baru, with its mix of light, medium and heavy industries. Among them are marine and industrial complexes. These entities serve domestic and international maritime and oil and gas industries, focusing on the core activities of ship repair, shipbuilding, and onshore and offshore engineering.

The 1992 amendments to Annex I of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), which is concerned with oil pollution, brought in "double hull" requirements for tankers and also considerably reduced the amount of oil ships could discharge to the sea (for example, following cleaning of cargo tanks or from engine room bilges). Oil tankers had been permitted to discharge oil or oily mixtures at the rate of 60 litres per nautical mile; the amendments reduced this to 30 litres. For non-tankers of 400 grt and above, the permitted oil content of the effluent that may be discharged to the sea was reduced from 100 to 15 parts per million.

A "Waste to Energy" plant has been set up in Pasir Gudang to treat sludges and slops from ships. It can store and process oil-based wastes, particularly from ship repair operations, in order to recover oil and produce electricity. In addition, the facility can provide a total solution not only to its parent company but to other Malaysian industries for complete treatment of associated hydrocarbon wastes.

This is the first such facility in Southeast Asia. Its initial design capacity is to process 12,000 tonnes of oil sludges per year and 5000 tonnes of slops at any one time. The electric power it generates is utilized by its parent shipyard engineering company at its complex premises. Oil is recovered for sale and a waste water treatment plant treats contaminated water or water drained from slops before discharging to the ocean. The plant burns 1.6 tonnes of sludges per hour to produce 1.5 MW per hour of electricity. It meets national pollution and noise control standards.

The plant utilizes a bubble-fluidized bed combustion technology with similar applications in North America and Europe. This technology has proven very effective in burning sludge with a high moisture content, an area where other incineration methods have been found wanting. Another major advantage of the system concerns reduction of noxious gas emissions, with control of vaporization of heavy metals such as lead meeting the more stringent EC air emission standards.

Unlike the more conventional means of burning solid fuels in a fixed or travelling grate system, fluidized bed combustion technology relies on the extreme turbulence established by an upward flowing air stream in a "bed" of inert sand particles. Within a fluidized bed combuster, the turbulence in the vessel, the density of the sand mass and the scoring effect of the sand particles allow complete, controlled, uniform combustion – a key to maximizing thermal efficiency, minimizing ash and controlling emissions. Typical units can achieve carbon burn-out within the combuster well in excess of 99%.

Gaseous elements are fully burned in the incinerator's top section before the gas leaves the incinerator on its way to a boiler. The hot gas is then cooled in the boiler. The heat extracted in this process creates steam which turns a turbine, generating electricity. At the next stage the cooled incinerator gas is filtered in a bag house before passing up a stack. Ash is collected from the incinerator bed, the boiler and the fabric gas-cleaning bags.

Emissions from this combustion method are lower, since low combustion temperature and air staging within the bed reduce the formation of certain emissions such as NO_x. High combustion efficiency also results in flue gases containing smaller amounts of CO_2. Emissions such as SO_x or NO_x may also be abated by injecting limestone or ammonia into the bed. High combustion efficiency results in a reduced amount of inorganic material in the form of fine ash; with low toxicity levels, this is sold as input for other materials like cement.

This facility is operated by Techno Indah Sdn. Bhd.

Biofuels

Malaysia is the world's leading producer of palm oil.[1] In 1999, it produced 10,553,918 tonnes of crude palm oil. In 2000, it is projected to produce 10,799,150 tonnes.

Development and innovations in this important industry have been overseen by the Palm Oil Research Institute of Malaysia (PORIM). Even as

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this article was being written, however, a new statutory body, the Malaysian Palm Oil Board, officially came into being. It is operational as of 1 May 2000. With the establishment of the MPOB, both the Palm Oil Registration and Licensing Authority (PORLA), which has seen the orderly growth of the Malaysian palm oil industry through enforcement of regulations, licensing and quality control, and PORIM will cease to exist. These two bodies are now merged into the MPOB.

Diesel has been successfully derived from palm oil. Tests on motor vehicles have demonstrated its compatibility with internal combustion engines. While this renewable energy source has been shown to be a viable fuel, market acceptance has not materialized for commercialization. Private enterprise has now introduced a palm oil based additive for combustible fuel, to be used in both petrol and diesel fuelled vehicles, and a palm oil based engine oil. The non-toxic additive is also said to reduce CO_2 emissions by 30% and CO emissions by some 27%. It helps enhance fuel combustion, with up to 98% of the fuel being burnt off instead of the normal 70-75%. This additive's most unique advantage is that it lengthens oil change intervals. It also reduces fuel consumption, increases engine power and extends engine life.

Malaysia has the reserve capacity to convert palm oil to motor fuel, as well as the supply to match the increase in demand. Widespread adoption of this biofuel could reduce demand for fossil fuel, as well as reducing greenhouse gas emissions to a certain extent.

This product is produced by Marvel Zone Sdn. Bhd.

Renewable energy technologies

Some promising and commercially viable renewable energy technologies that have been considered in Malaysia and elsewhere are presented below.

Biomass

At the moment, using biomass as a source of renewable energy is considered the most likely starting point on the road towards sustainable energy management. This is mainly due to its abundance in Malaysia. Huge amounts of waste (fibre, shells and empty fruit bunches, or EFB) are generated in palm oil mills, for example. The potential energy that could be harnessed from EFB alone is estimated at over 2.0 million Mtoe, or about 6% of the total national energy supply. Additional energy from biogas, generated as a by-product of anaerobic treatment of palm oil mill effluent, is also a potential supplementary energy resource.

A feasibility study on grid-connected power generation using biomass cogeneration technology was carried out by SIRIM, the Malaysian standards and research organization. The study was commissioned by the Ministry of Energy, Communication and Multimedia, with funding from the Malaysian Electricity Supply Industry Trust Account. In it SIRIM recommends that boilers in the cogeneration system use multi-fuel burners that are able to burn any type of solid biomass fuel, such as wood chips or sawdust. It also recommends supplementary fuel oil, to ensure continuous power supply to the grid. Cogeneration facilities are particularly viable in integrated palm oil complexes that require both steam and power.

The following assumptions were made in order to produce a standard comparison of the demonstration plants:

- power generating capacity of 5 MW;
- plant load factor of 90% and parasitic load factor of 10%;
- fuel characteristic: EFB moisture content of 40%;
- 85% boiler efficiency;
- 50% of project cost financed at a fixed rate of 10% over five years;
- total of 8 300 plant operating hours per year;
- number of personnel required to operate the power plant: nine per shift;
- maintenance cost at 3% of equipment costs;
- electricity produced sold to the grid at 16 sens per kWh;
- ash sold at RM120 per tonne;
- each site given pioneer status tax exemption for the first five years.

The economic feasibility study was done using the Standard Techno-Economic Model (STEM), which has four main sections: general data on the energy plant; mill data; energy plant data; and cash flow table.

The study also looked at the greenhouse gas emission reduction that might be expected after biomass cogeneration plants were set up at each potential site. Potential GHG emission reduction was 23,334 -26,839 tonnes of CO_2 equivalent per year. These figures take into account the fact that almost all the potential sites currently use diesel to run their boilers and generators.

Potential emission reduction is 12-85% for NO_x and 89-97% for SO_x. These figures basically reflect the lower sulphur and nitrogen content of biomass fuel compared with diesel, as well as the average emission from electricity generation in Malaysia.

In addition to that of SIRIM, another study on the feasibility of new power plants fuelled by palm oil waste was carried out by a subsidiary of the TNB group, led by a North American company. It looked at a centralized power plant with biomass fed from 10 nearby mills, thus allowing for economies of scale and improvements over smaller plants. This study shows a large potential for power generation beyond the mill's own requirements.

These studies demonstrate that there are no unresolved technical issues concerning conversion of biomass into usable energy. Apart from the EFB readily available from palm oil mills, biomass can be obtained from tree cropping, pruning and undergrowth clearing. More also becomes available when large areas are replanted in oil palm and rubber plantations. In the process, old trees are either felled and burnt in the open (with the approval, and very close and stringent monitoring, of the Department of Environment) or left to rot in the field.

In Malaysia's urban areas, town beautification and horticultural activities are gaining in popularity. Biomass from these sources can also be better used as an energy source (anaerobic gas production or biomass fuel) than by open burning or sending to landfill. However, technical, logistical, economic and financial issues must be addressed if these methods are to be implemented. Major attitudinal and perspectival changes are also needed, among the population, government decision-makers and businesses, in line with sustainable development concepts.

Solar energy

Malaysia has abundant sunshine throughout the year. Though it would seem natural to assume that solar energy would be well utilized, the reverse has been the case. Up until now, the only semblance of solar energy use has been passive water heating in some residential units and generation of electricity by photovoltaic systems in remote areas and for experimental purposes. The relatively low cost of grid-supplied electricity, the high initial cost of PV panels and of their installation, plus the marketing strategies for mains-supplied electric appliances, have severely curtailed the emergence of this energy source as a major component in the national energy mix.

It should be noted that experiments in the United Kingdom and Japan have demonstrated the viability of this energy source. In Japan, some houses have solar panels on the roof. Electricity generated during the daylight hours is channelled to the grid to help meet high energy demand, at a time when household demand is at its lowest; the dwelling uses electricity from the grid between dusk and dawn, when grid demand is low and household demand is high. From an economic point of view, this works out to be a wonderful equation. Houses act as nano-generators during the peak demand period, selling their output to the grid at a higher price. Then they buy from the grid at a lower price. What has been hindering adoption of this technique is people's attitude to power generation factors, as well as the lack of policy and strategy innovation at the government and power suppliers' organizational levels.

Of late there has been increased activity to consider the viability of solar energy in Malaysia. A subsidiary of the National Power Company (TNB) is conducting a study to assess the performance of a grid-connected rooftop 3 kW, three-phase photovoltaic system. This study will observe the technical capability and commercial viability of the system and its behaviour during peak load demands. A survey to gauge acceptance of this system among potential power system operators and the public is also to be conducted.

In late 1999, the Malaysian Energy Centre initiated a programme using solar photovoltaics. The objective of this programme is to evaluate the applicability of PV systems in Malaysia's climate by monitoring and collecting data on system performance at different locations. At the same time, this technology will be introduced to people in remote locations. The programme uses thin film amorphous silicon technology capable of 12 Wp. Another project will assess the performance and commercial appeal of solar street lighting along highways.

If findings from these studies are encouraging and show that solar power is a viable energy alternative, public relations and awareness campaigns

may be needed to achieve mass acceptance in urban areas. Towards that goal, regulations can be fashioned to stimulate a demand for solar power. This might include changes to building codes and rethinking of architectural principles. Urban local authorities could impose conditions.

Translucent PV panels could be substituted for roofing tiles, offsetting the cost of roofing to some extent and allowing light into the building. The extra cost of the PV panels could be offset in the long run by energy savings due to the ambient light allowed in. Artificial daytime indoor lighting is a common feature of high density urban building design.

Strategies promoting renewable energy use

I repeat below some strategies that Stephan Schmidheiny of the World Business Council for Sustainable Development (WBCSD) lists in his book *Changing Course: A Global Business Perspective on Development and the Environment*. Though some of the suggestions might be debatable, and could even be detrimental to development policies, they are presented here as strategies that could find acceptance in their suggested form, or an altered or amended form.

These strategies require actions by governments, local authorities, industry, international agencies (governmental and non-governmental), trade groups and associations at the international, regional and national levels, consumers and researchers.

Actions with immediate effects

- *Reforming energy pricing policies to reflect the full environmental cost of energy* by removing energy subsidies for use of polluting sources, such as through abolishing coal subsidies. Putting a value-added tax on electricity and gas;
- *Developing and setting standards* for products and appliances to make producers and consumers more aware of energy input, using, for example, life cycle energy accounting; energy efficiency standards for buildings; energy use and life cycle energy labelling of cars and refrigerators (refrigeration systems);
- *Attacking waste* through, for example, improving power plant efficiency in developing countries; encouraging cogeneration; promoting increased recycling of paper, glass, metals and used oil; capturing methane emissions from landfills, and reducing gas leaks and gas flaring.

Actions with medium-term effects

- *Making investments in energy-efficient technologies more attractive*, such as by priming emerging markets for new energy-efficient products through government purchasing schemes for new products such as refrigerators, housing and equipment in public projects, and providing financial and infrastructure support for introducing energy-efficient products in developing countries;
- *Shifting the energy mix towards more sustainable sources*, for example through integrating alternative energy sources into present infrastructure; increasing the share of small-scale hydropower projects in developing countries; promoting more efficient use of biomass, especially in developing countries;
- *Accelerating research in promoting technologies* such as biomass gasification, clean coal technology, next-generation nuclear power plants and hydrogen through joint industry-government research programmes, and refocusing of national research programmes;
- *Improving access to the latest energy technology and management expertise* in developing countries through building up training programmes and infrastructure for the introduction of new technology.

Actions with long-term and permanent effects

- *Increasing knowledge of climate change and its impact* by supporting research projects on climate change science and the impact of climate change, as well as economic policy implications and systems analysis;
- *Developing more efficient energy technologies* through research cooperation on fuel cells, intrinsically safe nuclear energy, photovoltaics and other solar energies, coal gasification, high-efficiency transport equipment and biomass based fuels;
- *Developing cost-efficient CO_2 sinks to compensate for emissions*, such as domestic and international afforestation programmes; research on CO_2 absorption; improved forest management and biomass handling;
- *Developing new urban and regional infrastructures that limit CO_2 emissions* through, for example, investment in new transport systems and new guidelines for urban and regional planning;
- *Evaluating the introduction of an "insurance premium"* on emissions of pollution even when we do not know the full environmental cost, such as through a carbon content levy;
- *Promoting changes in life styles* by encouraging public transport and more environmentally sustainable consumption patterns through better information on energy intensity of products, and education and public awareness programmes.

Specific initiatives by industry

- *Assessing energy efficiency investments at the lowest discount rate applicable to any investment*; for utilities, setting up "best practice" systems to aid developing country utilities; setting up joint international efforts to tackle major projects, such as gas pipeline leaks in the former Soviet Union; taking the lead in energy use labelling of products and processes;
- *Making staff available to help eastern European and developing country companies with energy efficiency and audit efforts*; initiating, with governments, long-term energy strategies that are consistent at the national, regional and global level, such as the Japanese Action Programme to Arrest Global Warming ("New Earth 21").

Conclusion

The use of commercial parameters needs to be encouraged when dealing with energy sources in urban areas. Businesses, which are the backbone of urban areas, should be built on sustainability concepts. Accounting principles should follow the triple bottom line approach, with primacy given to environmental, ethical and social costs and gains before pecuniary costs and gains. Decisions should incorporate life cycle analysis concepts. I would also say that life cycle accountability should be introduced, to instil a sense of responsibility for commercial actions taken which could have dormant catastrophic potential for both the urban population and the environment.

Renewable energy management in the context of urban environmental management faces great challenges. The ubiquitous motor vehicles are approaching something of a Mephistophelean nature in urban areas. Urban populations have learned to live with the mephitic atmospheric pollution, but the question being addressed is whether the Earth can go on as a living planet. Once it dies, everything else also ends. Policies and strategies to address resource depletion and greenhouse gas emissions have to emanate from the invisible hand of the private enterprise market economic system before cities become hollows without souls.

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Note

1. See, for example, Gurmit Singh, The Malaysian oil palm industry: progress towards environmentally sound and sustainable crop production, *Industry and Environment* Vol. 22, No. 2-3, pp. 45-48.

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Sustainable utilities: new opportunities for sustainability through liberalization and privatization

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Abstract

Utilities have major impacts on environmental quality, especially in urban areas. At first glance, liberalization or privatization of utilities would not appear to offer any environmental benefits. If such a change occurred within an adequate administrative-legal framework, however, the result could in fact be increased attention to sustainability. In this context, a case study of opportunities for improving sustainability in regard to road transport is presented.

Résumé

Les entreprises de distribution d'énergie ont des impacts majeurs sur la qualité de l'environnement, notamment en zone urbaine. A priori, il n'y a aucune raison pour que la libéralisation du marché ou la privatisation de ces entreprises ait un quelconque effet positif sur l'environnement. Pourtant, si ces changements s'opéraient dans un cadre juridico-administratif approprié, ils pourraient, davantage encore, attirer l'attention sur les questions de développement durable. Une étude de cas sur les possibilités de faire progresser le développement durable dans le secteur des transports routiers dans ce contexte est ici présentée.

Resumen

Los servicios públicos tienen una gran influencia en la calidad medioambiental, sobre todo en los núcleos urbanos. A primera vista, la liberalización o privatización de estos servicios no parece ofrecer ninguna ventaja. Sin embargo, si el cambio se produjese en un entorno legal y administrativo adecuado, podría coadyuvar a que se prestase más atención a la sostenibilidad. En este contexto, aquí se presenta un caso sobre las oportunidades de mejorar la sostenibilidad en lo relativo al transporte viario.

In the past, governments have always believed that in view of the typical economic characteristics of utilities there was only one way to ensure that they were kept up to par. In general, this approach has encompassed strict government control on one hand and the protection of utilities against competition on the other. Utilities were long regarded as natural monopolies exempt from the normal rules of the market, particularly in view of their inextricable relationship with infrastructure. After all, water, transportation and electricity could only be provided if suitable infrastructure was in place. And infrastructure, unfortunately, was and is difficult to duplicate.

The enormous investment required to build new infrastructure, and the slow pace at which these costs could be recovered, effectively prevented the realization of alternatives. Governments developed two scenarios for monitoring natural monopolies: public ownership and public supervision.[1] The usual justification for public ownership was the fact that utilities were a potential source of public income. In the case of public supervision, commercial exploitation was considered to be in the best public interest. Risks associated with what was in effect a private monopoly could be mitigated by ensuring adequate public supervision.

In recent years, however, utilities have lost their status as an undisputed public good. New developments, including technological progress and far-reaching legislative changes (e.g. ongoing Europeanization), are occurring rapidly and transforming the utilities sector. New ideas are shaking the once infallible belief that market forces do not apply to natural monopolies.[2] Old paradigms are being replaced by new ones, and governments are having to develop new scenarios.

The liberal wind blowing in the Netherlands and other western European countries is breaking open protected markets. Proponents of this process expound on the benefits of liberalization and privatization for society at large.[3] The utilities are also affected by these developments. There is much concern about their "marketing". One fear is that universal service and affordability might no longer be guaranteed. We will focus here on new opportunities for sustainability that may arise from public utilities' privatization and liberalization.

This article is written from the perspective of urban environmental management. The relationship between utilities and sustainability is of particular concern in regard to the urban environment because of the major impact the utilities tend to have. By extension, the opportunities that privatization and liberalization provide with regard to sustainability are particularly interesting for the urban environment.

The tone of this article is tentative. The developments described are still in progress and are in no way completed. Consequently, there is an almost complete lack of empirical evidence. The article should therefore not be regarded as a systematic and empirical evaluation of the effects of these developments on key sustainability variables.

Assumptions

This article is based on two assumptions which will remain undisputed here. We assume first that utilities in general have a considerable impact on the quality of the environment, and second that individual utilities may offer major opportunities for enhancing environmental quality. The examples below, which pertain to different utilities, serve to support these assumptions.

The energy sources – renewable or non-renewable – used in a society are largely determined by the power sector. This sector also bears primary responsibility for power generation processes and the resulting emissions. It has considerable influence on a society's total energy consumption.

The public transportation sector co-determines a society's "modal split". Its actions are an important determinant of the number of motorists who make the switch to public transportation such as the bus and train. In this way, the sector may reduce total car mileage and ultimately reduce total environmental damage (fuel use, exhaust emissions, noise pollution, etc.).

Activities carried out by the waste sector impact directly on the environment. Waste collectors and processors ensure that waste is collected, recycled

and processed (burned or dumped). They are the cleaners of our environment in the broadest sense and have an important role in waste prevention.

At the level of the individual organization, a utility can choose to use selected environmentally friendly products and process innovations. Innovation has a major marketing advantage, in that the utility can continue to provide the same service at a lower cost to the environment. Environmental benefits can be realized in several ways. A company may develop alternatives for scarce (non-renewable) resources or reduce hazardous emissions. A power company switching from fossil fuels to sustainable sources of energy (e.g. solar or wind) would be achieving both objectives.

A new paradigm

Perhaps the most important reason utilities are now being subjected to market forces is the adoption of a new paradigm in the field of economics. What was once dismissed as impossible is now considered both feasible and desirable. Like the old paradigm, the new one accepts the difficulty of duplicating infrastructures. However, this conviction does not necessarily lead to the conclusion that the entire production column must be organized as a monopoly. In the new paradigm, the utilities production column is regarded as a chain of distinct links and the necessity of a monopoly or the feasibility of competition must be assessed for each individual link (production, transportation, supply). By distinguishing infrastructure management from the provision of services, for example, components of the utility production column can be opened to competition and market forces. New insights show that competition at the level of services may be feasible.

Liberalization and privatization: paradoxes and opportunities for sustainability

Varying degrees of liberalization can be implemented in the utilities sector. The most dramatic form is competition between infrastructures, which requires the existence of at least two. In this situation, users can choose which supplier they want to do business with. When competition between infrastructures is not possible, various companies provide a similar service using the same infrastructure. The third type of liberalization is competition for access to the infrastructure. Concessions to exploit and/or manage the infrastructure are periodically put out to tender by the government that owns the infrastructure. In its mildest form, there is no direct competition but benchmarking does take place: that is, comparisons of performance are made by a third party. Benchmarking that could have consequences for a company (such as concession loss) is called "yardstick competition".

Privatization also comes in varying degrees. The most far-reaching form is, of course, full private ownership. In other words, the utility is a private company whose shares are owned by private shareholders and which falls under private law. In a less drastic form, the utility may be publicly owned but placed at such a distance from the government that it no longer falls under its political responsibility. In this case, too, the utility's legal status is that of a private company, but its shares are owned by the public administration. The mildest form of privatization is that in which the utility is in the hands of government and falls under the government's political responsibility, but otherwise operates "commercially". In this case, the utility must be given sufficient freedom to decide its own managerial and financial course.

Liberalization is a potential threat to sustainability. After all, competitive businesses tend to slim down operations and seek to maximize efficiency and effectiveness. Proposed investments that enhance sustainability may be dismissed as "unnecessary" or a "luxury". By contrast, a business with a long-term monopoly can afford to take measures that enhance sustainability but do not have a quick return.

Paradoxically, however, breaking open the market may also boost sustainability. An open market implies that more companies are active, either on the same market or on different markets, but that they periodically attempt to take over other markets. When a market is populated by multiple competing companies, direct comparisons of performance can be made. Such comparisons need not be limited to the quality and price of the delivered products, but may also extend to environmental performance (emissions reduction and efficient resource use). Consumers choosing between two service providers may consider a company's "green" image in their decision. Another benefit of liberalization is that it stimulates innovation. Product and process improvements are opportunities for a company to set itself apart from its competitors. Companies with a monopoly position lack this incentive to improve.

Privatization, too, poses a potential threat to sustainability. A private utility is more likely to pursue a singular goal, that of continuity. The company must obtain a maximum return on invested capital. For that reason it will disregard other values, such as sustainability, from the point where its continuity might be at stake. A public utility, on the other hand, pursues several objectives, of which financial profit is only one. Other objectives include providing a universally guaranteed service and realizing sustainability.

Paradoxically, however, privatization can enhance sustainability. Publicly-owned utilities are sometimes handled with kid gloves by the government. It may, for example, apply more relaxed environmental licence standards or take a lenient attitude when standards are not met (the so-called "tolerance policy"). This cautious attitude is often the result of conflicting interests. The government has a financial interest as owner of the utility, but it is also a public authority responsible for assessing licence applications and monitoring compliance with legal standards. Personal and political factors might also be involved. A privatized company operating at a distance from the government is less susceptible to such conflicts of interest, so that the authorities will be less inclined to take a lenient attitude.

Strictly speaking, privatization does not necessarily enhance innovation. A private monopoly can afford to be just as lazy as a public monopoly. In private monopolies, only those innovations which increase profits can count on an enthusiastic response and external pressure groups may find it difficult to push the company to adopt other types of innovations. Innovation, after all, is not something that can be enforced.

At first glance, neither liberalization nor privatization would appear to hold any benefits for sustainability. A closer look, however, leads to a different view. Liberalization, in which multiple companies are active on a market, enables a comparison of the companies' performance, for example in environmental matters. The results may be used to set the best-performing company as the standard for the other companies. Privatization increases the distance between the government and the utility, making it easier for public authorities to treat the company objectively and professionally. In time, this may result in a stricter monitoring of the company's environmental performance.

Both liberalization and privatization provide opportunities for sustainability. These opportunities are particularly interesting for the urban environment, on account of both the major impact utilities tend to have on the urban environment and the considerable environmental benefits they may produce. Both liberalization and privatization may result in improved environmental performance, provided the government succeeds in channelling these developments in the desired course. Optimal utilization of opportunities depends on the government's ability to develop an adequate administrative-legal structure.

Potential scenarios

Legislation that recognizes the spirit of the market

In the utilities sectors, preference should be given to administrative-legal structures that recognize to a greater or lesser extent the economic rationale of the market. Legislation and economy have different rationales, and the ability of legislation to influence the market depends on how well it dovetails with the economic rationale. Thus, government measures that have financial consequences are generally more successful in steering corporate activities than those that appeal exclusively to moral conscience. Instruments that recognize the realities of the market (e.g. production or user levies) can play a role here.

Optimal influence or direction is achieved using incentives as well as penalties. Certainly a company should be fined for not meeting environmental standards. However, the best way to stimulate companies to realize environmental goals is to offer a reward to those that make the extra effort. A public authority, for example, could consider past environmental performance when assessing concession applications and give the concession to the company with the best environmental score. In this case, legislation need only lay down minimum performance criteria.

Two ideal administrative-legal structures

Below we roughly sketch two ideal administrative-legal structures that incorporate the realities of the market: an adapted version of a traditional structure, and a modern inspection and/or certification structure.[5] The adapted version of the traditional "command and control" structure is based on the traditional licensing system. However, granting of a licence is conditional on general targets being met rather than on compliance with specific measures. A company is free to decide by which means to achieve these targets, which may be based on best practices. The inspection and/or certification structure does not involve a licensing system. Instead, the government demands that a company wanting to provide a service be accredited. A company is accredited if it meets the criteria of a certification system carried out and monitored by a third party. These criteria may also be based on best practices.

Case study: road transport

Current situation

Currently, road management is an almost exclusive domain of government. The government has a monopoly on the roads: it is the sole builder and owner of roads and highways, and the only party engaged in road maintenance. Private road management is practically non-existent. Would liberalization and privatization provide new opportunities for sustainability here? To answer this question, we have sketched a future scenario in which utilities have been privatized and face increased competition.

The road transport sector plays an important role in regard to the sustainability issue. Road construction and use cause considerable environmental damage. This applies strongly to the urban environment. Landscapes are severed by broad stretches of asphalt. Motorized traffic not only uses a lot of fuel, but also emits toxic emissions and causes noise pollution.

Environmental impacts are particularly dramatic in urban areas. Measures to reduce the environmental impacts of road transport can be implemented at two levels: that of the road user, and that of the road itself. Measures aimed at road users include technical requirements to increase traffic safety, taxes on fuel to reduce total mileage, and higher road taxes for heavier cars. Road measures include maximum speeds and special provisions in areas flanking the road. Maximum speeds are established primarily for traffic safety reasons, but have positive environmental effects (less noise pollution, lower fuel consumption and reduced emissions) as well.

Special provisions include noise barriers along roads that exceed traffic density standards and run through built-up or sensitive areas. These provisions are required under a generic scheme to restrict noise pollution.

Possible future scenario

Liberalization and privatization of the road transport sector is feasible in the form of electronic road pricing systems that will enable road exploitation to be contracted out to third parties. These systems are expected to be operational and profitable in the near future. Private companies could then apply for a licence to exploit a certain road during a set period, for which the government would pay a certain remuneration. The exact financial arrangement would of course depend on who pays the costs of road construction, including those of purchasing land on which to build the road and those of measures to mitigate environmental damage. Liberalization could be realized by, for example, putting a concession out to tender every 10 years. In this case, private companies would be competing for the market. The company obtaining the road management licence would for the time being have the road market or, more broadly, the mobility market to itself. Its services, for which motorists would have to pay a fee, might consist of facilitating a smooth journey without delays from A to B, with a money-back guarantee should congestion nonetheless be encountered.

New road management would bring with it new sustainability opportunities. The road manager would be subject to environmental permit laws, requiring compliance with several environmental standards. The advantage of this arrangement is that the road manager can be held accountable for the environmental results achieved. The road manager would be responsible for meeting environmental standards or risk losing his permit, which would force him to stop all business activities. This threat should be enough to ensure that a road manager makes every effort to comply with environmental regulations. Delegating responsibility can thus stimulate creativity and result in optimal performance.

Environmental performance can also be stimulated by introducing new administrative-legal structures such as those concerned with "pollution rights", which could be made available in the form of a pollution quota, an immaterial quota of activities causing environmental damage. The benefits of this structure would be two-fold. The quota clearly defines a road manager's task, while at the same time stimulating optimal use. For example, damage to certain individual environmental aspects could be weighed against improved performance on other aspects or, within certain margins, discounted over time. Ultimately, both public environmental interests and private business interests could be satisfied.

Opportunities for sustainability

In a privatized sector, the road manager would be encouraged to innovate. As a provider of mobility, the road manager's first action would likely be to offer road space to motorists. Before long, however, he would be exploring other opportunities to provide mobility on "his" route and adjoining ones. In the long run, the road manager could also help develop and invent measures to increase road capacity. Such measures might include the development of vehicle guiding systems or more effective noise barriers.

Liberalization would enable more companies to be active on this market. These companies would compete to be the best and fastest to utilize the new opportunities for sustainability, since a head start in sustainability know-how would also give a head start in the race for concessions.

Closing remarks

The liberalization and privatization paradoxes are rather optimistic assumptions that will only hold true if governments succeed in utilizing the resulting new opportunities for sustainability. We have made some practical suggestions to this end in the case study above. In any event, both government and industry must respond alertly. It is also possible to ignore opportunities, at the risk of poorer environmental performance by utilities. Governments that are not on the ball may miss out on opportunities that will not soon present themselves again. Once it happens, environmental damage is irreversible.

We are somewhat sceptical about governments' willingness to understand just how crucial this point is. Our scepticism would appear to be justified, in view of the Dutch government's poor record on making the most of new opportunities. The potential benefits of liberalization and privatization, with respect to the quality and price of utilities, are (still) not being realized.

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Notes

1. Damme, E.E.C van (1998) Concurrentievervalsing door de overheid. In: *Openbare Uitgaven*, No. 4, pp. 194-203.

2. Künneke, R.W. (forthcoming) Electricity networks: how natural is the monopoly. In: *Utility Policy*.

3. Twist, M.J.W. van and E.F. ten Heuvelhof (1999) Concurrentiebevordering in infrastructuurgebonden sectoren. In: W. Derksen cs. *Over publieke en private verantwoordelijkheden*, The Hague, pp. 217-55.

4. Bauer, J.M. (1998) The role and evolution of public utility regulation. Tasks of regulation in an era of partial competition. Paper presented at 40th NARUC Annual Regulatory.

5. In this article we do not discuss the private law approach: e.g. a structure in which open standards laid down in general legislation are sanctioned by liability law, which pretty much comes down to "judge's law". The advantage of a private law structure is that the costs of regulation are paid by the private sector, i.e. the parties who benefit from the service (producers, consumers), rather than by taxpayers. ◆

Transforming post-industrial areas as an urban environmental policy tool (Katowice, Poland)

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Abstract

Political changes have created the possibility to restructure industrial areas in Poland and other Central and Eastern European countries. Initiatives related to improving brownfield areas in the Katowice agglomeration reflect the region's industrial development. From the local authorities' perspective, transformation of post-industrial and other degraded areas of the Katowice agglomeration is an essential part of urban renewal and sustainable development activities.

Résumé

Les changements politiques intervenus en Pologne et dans d'autres pays d'Europe centrale et orientale ont rendu possible la restructuration des zones industrielles. Les initiatives prises pour dépolluer les terrains en friche de l'agglomération de Katowice sont typiques de la politique de développement industriel de la région. Pour les collectivités locales, la transformation des zones post-industrielles et autres zones dégradées de l'agglomération de Katowice est un aspect essentiel de la rénovation urbaine et de la mise en place d'activités favorisant un développement durable.

Resumen

Los cambios políticos que se han operado en Polonia y en otros países de Europa central y del este, han hecho posible la reestructuración de sus polígonos industriales. Las iniciativas relativas a la optimización de brownfields (polígonos industriales baldíos) en la aglomeración de Katowice son reflejo del desarrollo industrial de la región. Desde el punto de vista de las autoridades locales, la transformación de las áreas postindustriales y de otras áreas improductivas de dicha aglomeración constituye una faceta esencial de las actividades de rehabilitación urbana y desarrollo sostenible.

The Katowice agglomeration, on the Silesian upland in south-central Poland, is considered one of Europe's most highly industrialized, densely populated and environmentally devastated areas. It is the largest Polish agglomeration, with over 1000 km² and 2 million people.

Heavy industry has determined this area's environmental quality. Since the 19th century, it has been an industrial region with an extremely high concentration of industry based on coal, lead and zinc. In the past, coal mines and factories gave rise to the development of towns. Worker settlements usually developed around industry. Old plants are often found among residential buildings. The spatial structure of the Katowice agglomeration consists of a mixture of different types of land use. Its towns suffer from the lack of separation of industry from residential areas. The landscape is dominated by heavy industrial plants, coal mines, shafts, derelict areas and solid waste heaps.

The changes in Poland's political system since the early 1990s have been accompanied by a difficult process of national restructuring whose aim has been to reintroduce a market-oriented economy. Socio-economic changes have been especially painful in highly industrialized areas, of which the Katowice agglomeration is an important example. This region was once a workhorse of the national economy. Political changes have created the possibility to restructure the entire area. Closing down, privatizing and transforming numerous industrial plants has caused a shift in the activities of numerous local communities, often making it possible for them to undertake other than purely industrial tasks. While this makes new economic developments possible, necessary steps need to be taken towards making degraded areas, construction and industrial sites more environmentally secure. The process of transforming post-industrial areas is very complex and spread over time. In order for it to proceed smoothly, both the internal structure of the areas involved and the goals and conditions of their transformation need to be determined.

Types of post-industrial areas

The basic classification of post-industrial areas distinguishes between:

- degraded and heavily contaminated areas requiring complex reclamation treatment;
- areas in which transformation and acquisition of new functions is currently feasible, including restoration of economic value and usability.

Every post-industrial area has features clearly related to the character of its previous economic activities. The criteria for classifying such areas include size, configuration, origins, structure, physical and chemical characteristics, and links to previous economic activities. With regard to the latter, one can distinguish three types of post-industrial areas:

1. areas where there was previous industrial activity (e.g. those in which mine shafts, storage yards, water reservoirs and land occupied by industrial plants are located);
2. industry-supporting areas (logistical centres, telecommunications sites, administrative and technical services, safety zones, sewage treatment facilities);
3. areas that remain under the impact of industrial activity (e.g. those exposed to pollution of the natural environment or dominated by working class housing projects, etc.).

Successful reclamation of post-industrial areas is determined by factors both internal (e.g. an area's susceptibility to transformation) and external (e.g. the opportunity for development).

Internal factors influencing the feasibility for an area to undergo restructuring include an inherent degree of environmental risk. On the other hand, among external factors determining the chances of successful restructuring of a post-industrial area are its infrastructure and transportation accessibility, as well as legal regulations governing the local real estate market.

Aims of restructuring post-industrial areas

The strategic aim of restructuring post-industrial areas is to bring about equilibrium between such areas and their surroundings. The existence of such an equilibrium is achieved when, for instance, mutual relations are beneficial for the parties involved.

Taking into account the sustainable development principle of post-industrial areas' restructuring process, it is worth stressing the opportunities such transformation phenomena create for local government agencies in relation to the planning and management of an urbanized environment. This process can be illustrated by describing the implementation of a few pilot projects, a common initiative of the UN and local governments of the Katowice agglomeration.

The UN project "Urban Environmental Management and Sustainable Development", developed according to sustainable development rules, assists municipalities both by supporting local teams dealing with city planning and management, and by providing tools that the municipalities can use in the process.

A working group dealing with issues concerning post-industrial areas' transformation in the Katowice agglomeration was formed in September 1997. Its internal structure has emerged during workshop sessions.

The working group includes two task teams. The first is focused on highly degraded areas requiring complex reclamation treatment, as well as on actions to protect inhabitants and the environment from these areas' harmful impacts. The second team has been creating databases on post-industrial areas and target objects that could potentially be adapted to novel functions activating the particular area and increasing its economic value.

Actions taken up by the two task teams have resulted in the implementation of four pilot projects. Each project presents a specific type of post-industrial target object or area and necessarily remains at a different phase of implementation. Regardless of the stage of their advancement, all the projects are interesting since they represent certain segments of a broad spectrum of issues related to transformation of industrial sites. One is focused on a large area that has been devastated and degraded by the coke-chemical industry. The second concerns land use changes following reclamation of a municipal waste landfill. Solving yet another range of issues is being attempted through a third project concerned with the adaptation for new uses of some valuable historic and industrial objects protected by law. Still another group of problems is being tackled by the fourth project, which concerns a land use proposal for areas regained after tearing down industrial premises located in the very centre of cities.

The goal of both the working group and the project is to elaborate the "bank of potential solutions" available to municipalities through the project. It is expected that these solutions will be a component of municipal strategies as well as an overall strategy for the Katowice agglomeration.

Particular solutions provided by pilot projects may be applied other places, respecting some local specific modifications. Hence the replication possibility is a primary advantage of each pilot project.

The pilot projects presented below address different aspects of post-industrial and barren areas. By the same token, this is a typical and representative example of significant number of such spaces and premises in the Katowice agglomeration.

The process of the pilot projects' preparation is associated with their typology assessment and clarification in respect of the adaptation capacity. Pilot project documentation, along with the set of solutions, is expected to create an informative database to serve the municipalities and their partners involved in the Katowice agglomeration's transformation process. It will also be a basis for elaborating the internal strategy for municipalities in the field of post-industrial areas.

Initial results are illustrated by the ongoing pilot projects described below in the cities of Ruda Sl., Siemianowice Sl., Chorzow and Czeladz.

Ruda Sl. City

"Pre-investment Study Preparation for a Local Plan of a Post-industrial Area Located within the Shut Down 'Wawel' Coal Mine and 'Walenty' Coke Plant"

This project comprises the following elaborations and documents:

- report on environmental risk assessment of the pilot project area (based on data analyses from the "Silesia Programme" – conducted by Polish and American partners);
- analyses of existing documents and elaborations in respect of legal requirements and financing possibilities;
- elaboration of functional and spatial concept (in two versions).

Siemianowice Sl. City

"Model Recultivation of the Landfill Area for Communal Wastes, in Order to Incorporate it into the Protective System of Siemianowice Sl. Green Areas"

In the pilot project documentation, a programme and technical concept have been elaborated for Sector I of the selected area and for the surrounding area (phase I), as well as a programme and technical concept for the remaining landfilled area (phase II). Part of the project is a proposal to use gas recovered from solid waste storage to heat houses near the landfill. The next necessary step will be elaboration of environmental risk assessment. All parties involved in implementing the pilot project (the Siemianowice Sl. municipality, the private firm "Landeco" and the above mentioned UN project) expressed the desire for further cooperation in order to implement the proposed solution.

Chorzow City

"Model Area and Transformation of the Shut Down 'Kosciuszko' Steelworks in the Chorzow Municipality"

The goal of the pilot project documentation is to prepare a solution compromising the expectations of the main interest groups, as well as the preferences of the Chorzow municipality.

There are two concepts of land use and objects' adaptation respecting the existing conditions, as well as the interests of the main economic partners involved in the investment.

The pilot project is assumed to be in the nature of a study, focused on a model and implementing issues concerned with the transformation of post-industrial areas. The proposed solution for land use in this area is based on strategic planning methodology, involving the use of a workshop method.

The local land use plan defines the area as industrial in nature. However, its future use will be associated with the development of service and communication functions locally and regionally.

The following strategic objectives have been defined:

- integration of industrial and urban areas;
- creating an attractive environment for inhabitants;
- strengthening of the town's image in the region and the country.

Two alternatives concerning function-spatial solutions have been formulated in order to realize the strategic objectives.

Alternative I: "Active Recreation Park"

Creation of a park area with a rich user programme, including: sport-related objects, active recreation equipment, entertainment, commercial and gastronomic objects. As a complementary area, exhibition halls and office buildings will be constructed. In this alternative, accomplishment by stages would begin in the area of the so-called "Upper Steel" processing plant, with adaptation of the existing industrial objects. Relatively small-scale individual investments would be made by a number of developers.

Alternative II: "Service Centre"

Creation of a service centre of a large city character, with a special function enriching the service offered by the urban Chorzow downtown area. One to three commercial objects of high architectural value in the area of the shut down steel processing plant would radically change radically the town's image. According to this alternative, it would be necessary to demolish the existing post-industrial objects in the area of the Upper Steel processing plant. It would also require engaging a limited number of strategic developers able to undertake large investments.

Both alternatives assume that redeveloping this area should be seen as a long process carried out together with the management of other, surrounding areas, beginning in the area of the railway station. This is associated with organizational activities lying beyond the range of the area's redevelopment. In order to assess and choose the optimum alternative, the following criteria have been selected:

1. investment efficiency;
2. communication function, in which the aspect of motor vehicle access to the area has been shown to be critical.

In the case of Alternative I, the first criterion was related to acceptance of a solution providing quick, immediately visible effects enabling later realization of the investment by stages, with the possibility of obtaining implementation effects step- by-step. This solution is based on a number of small investments, involving limited expenditure, carried out by local developers. Other advantages have also been taken into account, such as improvement of urban environmental quality and modernization of the urban communications system.

In Alternative II, significant financial benefits have been assumed from the large investment required. This is related to the necessity of finding

serious strategic investors with financial abilities. Other non-financial criteria were treated as complementary.

The number of parking places calculated in the analysis of the area's communications service can be obtained using either alternative. However, estimating the traffic efficiency of the existing communications system has shown that at present only Alternative I has a chance of being realized in a limited programme range. The effects of the redevelopment process, in the case of either alternative, depend on possibilities for redeveloping the area's surroundings, including above all access roads, parking places and multi-level garages in the area of the railway station.

For each alternative, two versions have been proposed. They differ in land management character, in how they address the communications service system, and in the number of investment lots.

Regarding the limits of transportation access using the first alternative, the following principles have been proposed:

- development of land-use functions not determined by the more than 200 parking places located in the project area;
- development of active functions first of all beyond rush hours.

The principles of the area's spatial development are assumed to be as follows:

- realization of spatial solutions following the general strategic line of the area's development;
- possibility of using the existing post-industrial objects and adaptating them according to the strategic land use objectives;
- creation of space for the public available to inhabitants, covered with trees and greenery and integrated with the urban centre;
- shaping of landscapes of high architectural value with consideration of the area's exposed location.

The proposed programme would include:

- "Active Recreation Park" with multi-cinema or garden-commercial centre as a basic function, and additional sports and recreation functions with mainly open-air equipment and gastronomic and commercial objects;
- "Centre of the Town Future", with an exhibition function and others associated with the town's promotion.

Based on the pilot project's elaboration, the Chorzow City Hall prepared an investment offer that was awarded second prize at the National Investment Fair in Poland.

Czeladz City

"Architectural and urban study of factory hall adaptation within the area of the 'Saturn Coal Mine' in Czeladz for the purpose of the University and three other projects dealing with restructuring of coal mine shafts in Katowice, Ruda Sl. and the city of Jaworzno."

These projects propose new activities and economic functions for existing premises with respect to their historical value.

The large number of post-industrial areas and old obsolete industrial objects in the Katowice agglomeration is expected to increase significantly in the coming years. This process is directly related to regional transformation. Therefore, local authorities as the formal hosts should not be passive towards ongoing changes, regardless of who is the legal owner of the municipal space. That is why they are authorized to control land use according to municipal policy and development strategy, through designation of new functions in such documents as *Study of Conditions and Development Directions of the Municipality Spatial Land Use*, as well as regulations included in local land use plans.

Pilot projects signal possibilities for transformation processes and demonstrate that a selected *modus operandi* has been adopted. Although these projects are limited in scope (as they are local initiatives), they not only allow testing of solutions applicable to such local settings but, through sharing experience and implementing municipal cooperation, contribute to a richer choice of urban environmental planning and management tools.

On the local and regional levels, such tools can help to:

- improve overall environmental conditions;
- develop local economies;
- preserve cultural heritage landmarks.

Respect for the principle of sustainable development in the process of transforming post-industrialized areas allows:

- minimizing the negative impact of implemented changes on natural environment;
- making use of local renewable resources and space in the process of adaptation to novel functions;
- respecting the interests of local communities with regard to such areas, as well as preserving their cultural identity.

The Katowice agglomeration is a special place on the map of Poland and of Europe. This old industrial region, experiencing the long-term results of excessive industrialization, now requires rapid and radical transformation.

The scope of the problem, primarily the size of the areas involved as well as the extent of their transformation, presents a huge challenge for the Katowice agglomeration's governmental agencies. Skilful management of transformation processes may secure a chance to successfully achieve the renewal and subsequent development of the Katowice agglomeration and of the entire region.

The activities described may be a valuable starting point for implementing sustainable development policy in the Katowice agglomeration. ◆

"What a waste": solid waste management in Asia

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Abstract

Nowhere is the global challenge of solid waste management greater than in Asia, which is rapidly urbanizing and increasingly becoming a "consumer society". Based on existing data and current trends, waste quantities and composition can be projected for 2025. At a minimum, waste quantities will double over the next 25 years, with the highest growth occurring in low income countries. Regional approaches are suggested, with an emphasis on broader business involvement.

Résumé

Nulle part le défi mondial de la gestion des déchets solides n'est plus problématique qu'en Asie, en raison d'une urbanisation galopante et des progrès fulgurants de la société de consommation dans cette région. A partir des données existantes et des tendances actuelles, il est possible de faire des projections de volumes et de composition des déchets jusqu'en 2025. Elles montrent que, dans le meilleur des cas, le volume des déchets doublera dans les 25 ans à venir, les maxima devant être atteints dans les pays à plus faibles revenus. Des approches régionales sont ici suggérées, en insistant sur l'importance d'une participation plus grande des entreprises.

Resumen

La gestión de desechos sólidos nunca ha representado un reto mayor que en Asia, que se está urbanizando rápidamente y se está convirtiendo progresivamente en una «sociedad de consumo». Basándonos en las cifras disponibles y las tendencias actuales, podemos calcular tanto la cantidad como la composición de los desechos para el 2025. Como mínimo, la cantidad se duplicará durante los próximos 25 años y el mayor aumento se observará en los países con menores ingresos. Se proponen enfoques regionales, haciendo hincapié en una mayor participación empresarial.

Introduction

As urbanization and economic development increase in Asia,[1] nowhere is the impact more obvious than in society's "detritus", or solid waste. Today the urban areas of Asia produce about 760,000 tonnes of municipal solid waste (MSW) per day, or approximately 2.7 million m^3. In 2025, this will increase to 1.8 million tonnes, or 5.2 million m^3, per day. These estimates are conservative: the real values are probably more than double this amount. Figures 1-3 show some projections of waste quantities and composition in 2025.

Local governments in Asia currently spend about US$ 25 billion per year on urban solid waste management. This amount is used to collect more than 90% of the waste in high income countries, 50 to 80% in middle income countries, and only 30 to 60% in low income countries. In 2025, Asian governments should anticipate spending at least double this amount (in 1998 US dollars) on solid waste management activities.

To carry out integrated solid waste management, local governments need partners. National governments must reduce the externalities of waste by considering measures such as full cost accounting, package deposits, manufacturer responsibility and extended product care. The general community, probably the most important stakeholder in waste management activities, must also actively participate in the solutions by modifying its behaviour patterns. For example, it needs to exert discipline in separating waste, using containers in a beneficial way, and exercising environmentally friendly purchasing habits.

Poor solid waste collection causes flooding and an increase in pests such as mosquitoes and rats, as well as their accompanying diseases. It is a large source of particulate air pollution (as waste is burned) and water contamination (as waste is dumped in rivers and canals). Solid waste is also a significant source of greenhouse gases. People know that poor waste management affects their health: 94% and 93% of those surveyed in India and China, respectively, agreed that "their health was affected by environmental problems" (*Washington Post*). Solid waste management is probably the single most important service a city provides, in that it is often their largest budget item, requires management capacity to do well (regardless of availability of funds), and is an absolute necessity for any city that wants to be considered of international repute. Solid waste management is usually a precursor for all other municipal services. No city will be able to earn the respect of its citizens, keep health care costs and threats of epidemics low, manage more complex services, attract sustained foreign investment or maintain a thriving tourist industry if it is unable to mange its waste.

Waste characterization

Severe under-recording of waste quantities is typical. Total waste generation is usually much higher than that reported by government agencies. Apart from localized anomalies, such as use of coal for cooking and heating, urban waste generation rates are generally consistent vis-à-vis local economic activity and residential wealth. Because waste characterization studies are relatively expensive to conduct, general "rules of thumb" should provide sufficient direction for the purposes of waste management planning.

MSW includes wastes generated from residential, commercial, industrial, institutional, construction, demolition, process and municipal services. However, this definition varies greatly among waste studies. Some sources are commonly excluded, such as industrial, construction and demolition, and municipal services. Often only residential waste is referred to as MSW, and in high income countries only 25 to 35% of the overall waste stream is from residential sources. It is important to define the composition of the municipal waste stream in a clear and consistent fashion. For example, if it includes construction and demolition waste, the quantity is usually doubled. Far too often waste management decisions are based disproportionately on residential waste, which accounts for an increasingly small fraction of the waste stream as an area industrializes.

Waste generation rates

Waste generation rates are affected by socio-economic development, degree of industrialization and climate. Generally, the greater the economic prosperity and the higher the percentage of urban population, the more solid waste produced.

Low income countries have the lowest percentage of urban populations and the lowest waste generation rates, ranging between 0.4 and 0.9 kg per capita per day. All countries that have a GNP per capita below US$ 600 generate less than 0.7 kg per capita per day. As GNP increases towards the middle income range, per capita waste generation rates also increase, ranging from 0.5 to 1.1 kg per

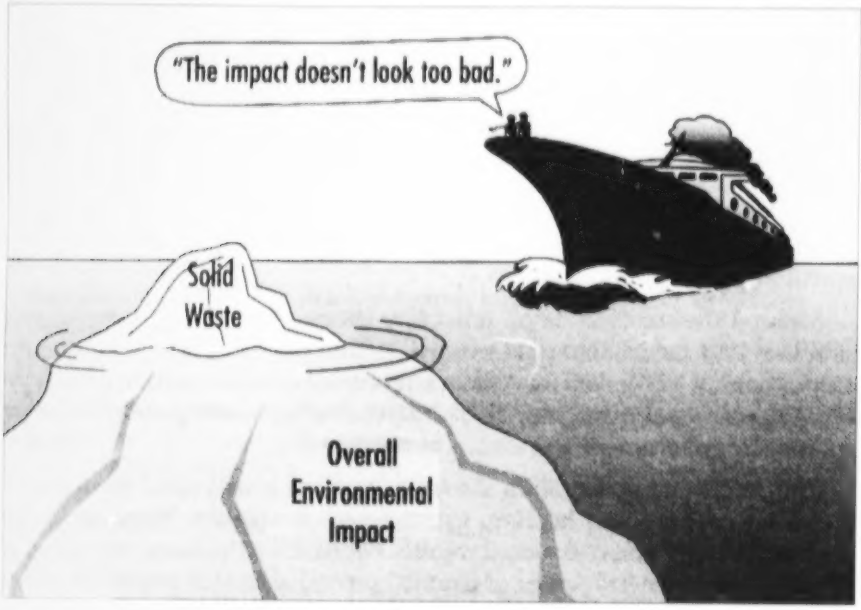
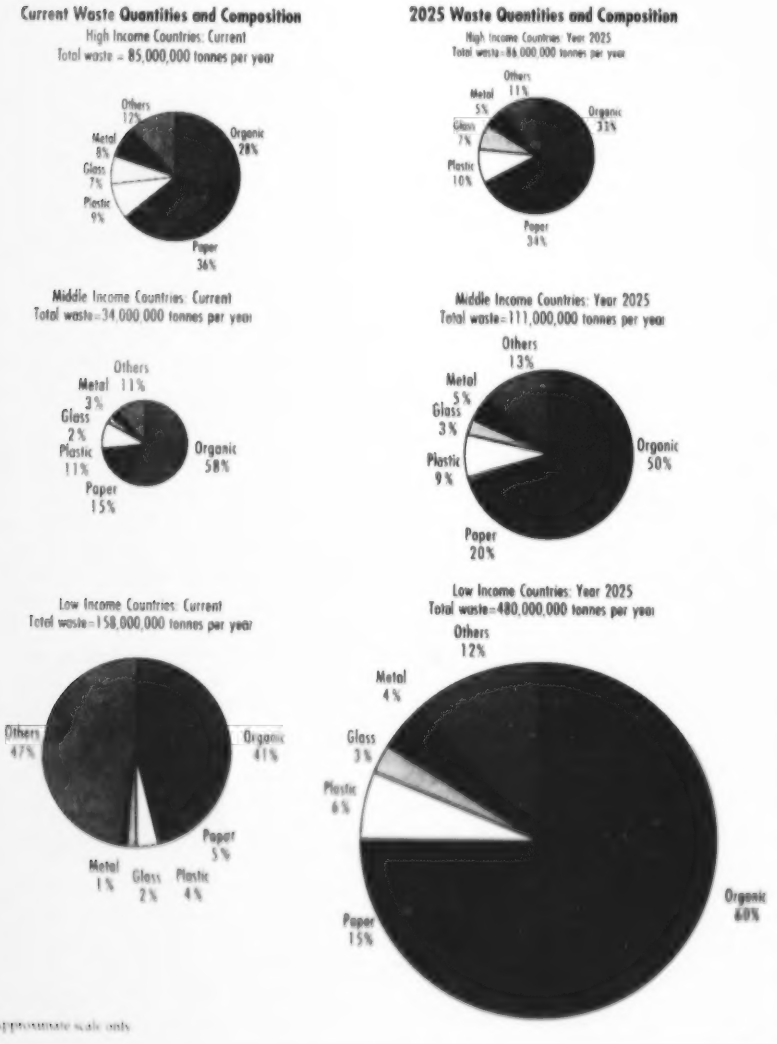


Figure 1
Waste composition of low, middle and high income countries



(a) Approximate scale only

day. The high income countries show the highest generation rates, varying from 1.1 to 5.07 kg per capita per day.

Hong Kong generates enormous quantities of construction and demolition waste, which explains its exceptionally high per capita MSW generation rate in comparison to other countries. Its waste generation rate better reflects the true quantities of waste produced by all activities within the municipality than that of some other countries. Although Singapore and Japan report significantly lower generation rates than other high and middle income countries, the figures presented do not represent all municipal solid waste. The Singapore generation rate considers only residential wastes, whereas the Japanese data include only wastes produced from households and general wastes from business activities. In the case of both countries, total waste quantities would be much higher if industrial, commercial, institutional, construction and demolition, and municipal services wastes were included.

Urbanization and rising incomes, which lead to greater use of resources and therefore more waste, are the two most important trends that factor into rising waste generation rates. For example, per capita use of resources by individuals living in India's urban areas is nearly twice that of those living in a rural setting. Because they consume and generate more solid waste, the Indian urban population is expected to produce far more waste per capita than its rural population. This difference between rural and urban waste generation rates also exists in other Asian countries, such as Bangladesh, where the rural population generates only 0.15 kg per capita per day while their urban counterparts generate 0.4 to 0.5 kg per capita.

Waste composition

Waste composition is also influenced by external factors such as geographical location, the population's standard of living, energy source and weather. Generally, all low and middle income countries have a high percentage of compostable organic matter in the urban waste stream, ranging from 40 to 85% of the total. China and India diverge from this trend because they traditionally use coal as a household fuel source. The ash is very dense and tends to dominate the waste stream in terms of weight. Ash, which is included in the "others" category, makes up 45 and 54% of waste composition in India and China, respectively.

The compostable fraction in high income countries, ranging between 25 and 45%, is significantly lower than in low and middle income countries. The percentage of consumer packaging wastes increases relative to the population's degree of wealth and urbanization. The presence of paper, plastic, glass and metal becomes more prevalent in the waste stream of middle and high income countries.

Waste trends

Waste quantities are inextricably linked to economic activity and resource consumption. Over the next 25 years, poverty in Asia is expected to continue declining (despite the recent economic

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crises). Besides economic growth, Asian countries are also experiencing urban growth rates of approximately 4% per year, a trend that is expected to continue for several decades. By 2025 the Asian population is projected to be about 52% urban.

China, for example, is experiencing rapid population and economic growth. Consequently, municipal solid waste is increasing in excess of 10% per year. Wuhan City, the capital of Hubei province, with a population of more than 6.8 million, has an extensive industrial base comprising metallurgical industries, manufacturing, textiles, transport manufacturing, oil processing, pharmaceuticals, electrical equipment, construction materials and food industries. According to Wuhan City's Environmental Protection Department, MSW quantities increased from 1.19 million tonnes in 1985 to 1.50 million in 1993. Not only are increases in waste quantities commensurate with the growing economy and expanding population, but the composition is also shifting towards plastic and paper packaging, a reflection of improved living standards (Figure 4).

The urban per capita waste generation rate for most low income countries will increase by approximately 0.2 kg per day, as these countries have relatively high annual GNP growth rates and urban population growth rates. As China, India and Mongolia become more prosperous and move away from coal, the traditional fuel, ash composition will greatly decrease and the percentage of compostable organic matter will increase slightly. Packaging waste, such as paper, plastic and glass, will become more predominant in the waste stream as the economies increase and the population becomes more urbanized.

By contrast, middle income countries should anticipate a per capita increase of about 0.3 kg per day since their economies are predicted to grow at the highest rates and will experience significant population growth in the urban sector. Indonesia and the Philippines will produce significant quantities of waste, which will require management with a still relatively small per capita GNP. Although Thailand and Malaysia will have the highest per capita waste production rates, they should also have stronger economies and more resources with which to begin implementing integrated solid waste management plans. Overall, waste composition is predicted to become even more variable as the percentage of compostable matter declines and packaging wastes, especially paper and plastic, increase.

As a whole, urban populations from low and middle income countries will triple their current rate of municipal solid waste generation over the next 25 years. Nepal, Bangladesh, Myanmar, Viet Nam, the Lao PDR and India can each expect their urban waste quantities to increase by about four to six times the current amount. By 2025, the low income countries will generate more than twice as much municipal waste as all the middle and high income countries combined – approximately 480 million tonnes of waste per year. Such a dramatic increase will place enormous stress on limited financial resources and inadequate waste management systems.

Figure 2
Current urban municipal solid waste generation

Country	GNP per capita[1] (1995 US)	Current urban population (% of total)[2]	Current urban MSW generation (kg/capita/day)
Low income	**490**	**27.8**	**0.64**
Nepal	200	13.7	0.50
Bangladesh	240	18.3	0.49
Myanmar	240*	26.2	0.45
Viet Nam	240	20.8	0.55
Mongolia	310	60.9	0.60
India	340	26.8	0.46
Lao PDR	350	21.7	0.69
China	620	30.3	0.70
Sri Lanka	700	22.4	0.89
Middle income	**1410**	**37.6**	**0.73**
Indonesia	980	35.4	0.76
Philippines	1050	54.2	0.52
Thailand	2740	20.0	1.10
Malaysia	3890	53.7	0.81
High income	**30,990**	**79.5**	**1.64**
Korea, Republic of	9,700	81.3	1.59
Hong Kong	22,990	95.0	5.07
Singapore	26,730	100.0	1.10
Japan	39,640	77.6	1.47

[1] World Bank, 1997
[2] United Nations, 1995
* estimated GNP
See Figure 3 for comparison with 2025

Figure 3
2025 urban municipal solid waste generation

Country	GNP per capita in 2025(1995 US)	2025 urban population (% of total)[1]	2025 urban MSW generation (kg/capita/day)
Low income	**1050**	**48.8**	**0.6-1.0**
Nepal	360	34.3	0.6
Bangladesh	440	40.0	0.6
Mynamar	580	47.3	0.6
Vietnam	580	39.0	0.7
Mongolia	560	76.5	0.9
India	620	45.2	0.7
Lao PDR	850	44.5	0.8
China	1500	54.5	0.9
Sri Lanka	1300	42.6	1.0
Middle income	**3390**	**61.1**	**0.8-1.5**
Indonesia	2400	60.7	1.0
Philippines	2500	74.3	0.8
Thailand	6650	39.1	1.5
Malaysia	9400	72.7	1.4
High income	**41,140**	**88.2**	**1.1-4.5**
Korea, Republic of	17,600	93.7	1.4
Hong Kong	31,000	97.3	4.5
Singapore	36,000	100.0	1.1
Japan	53,500	84.9	1.3

[1] United Nations, 1995
See Figure 2 to compare current rates

The per capita municipal solid waste generation rate in high income countries is expected to remain stable or even decrease slightly due to the strengthening of waste minimization progammes. The total amount of waste generated in 2025 will increase by a relatively small amount – about 1 million tonnes per day – compared to current waste quantities. Construction activity in Hong Kong is expected to continue. No immediate proposals are under way regarding how to reduce construction and demolition wastes. Thus, wastes from this sector will remain high and will keep contributing significantly to the municipal waste generation rate. Singapore and Japan have the lowest waste generation rates among high income and even some middle income countries, although these rates may reflect definition inconsistencies rather than waste minimization practices. These two countries have implemented integrated solid waste management plans, but it is unlikely that they will significantly reduce their waste quantities below current levels. The overall MSW composition for high income countries is predicted to be relatively stable. Only a slight decrease is expected in metal and glass wastes, increases should occur in plastic, paper and compostable wastes.

A different trend emerges when comparing waste amounts in terms of volume. On average,

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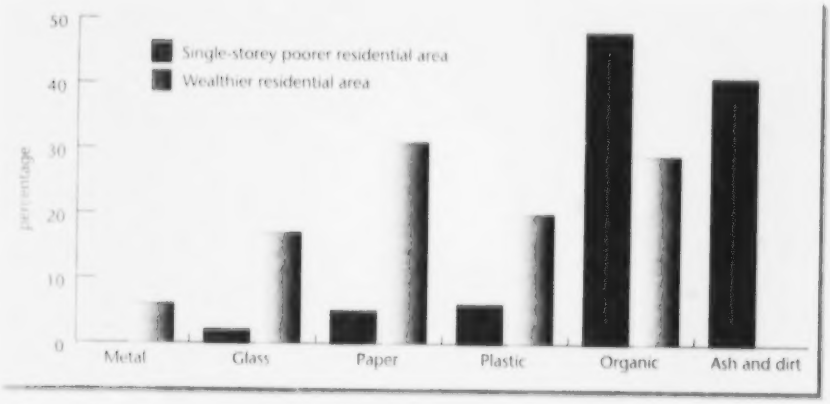
Figure 4
Variations in waste generation and composition by affluence: Beijing, China

Waste quantities and compositions vary not only among countries, but also among individual cities and communities within a city. The figure below illustrates the differences between the waste composition of two residential areas in Beijing. Wealthier households produce significantly higher percentages of paper, plastic, metal and glass waste, most likely from packaging materials. Compostable matter, such as food, horticultural and ash waste, are predominant in single-storey residential waste streams. The high ash and dirt content is from coal since use of gas is not yet widespread (Beijing Environmental Sanitation Administration, 1996).



waste densities of 500 kg/m^3, 300 kg/m^3 and 150 kg/m^3 were used to calculate the volume of waste generated in low, medium and high income countries, respectively. Whereas low income countries currently produce the greatest quantity of waste on a mass basis, high income countries generate the greatest quantity on a volumetric basis. This increase in volume is a result of paper, plastics, bulky wastes and other multi-material packaging prevalent in the waste streams of wealthier and more urbanized countries. Low and middle income countries have a larger percentage of high density organic matter and ash residues in their waste streams, which weigh more but do not take up as much space as discarded packaging materials and household goods (Figure 5).

In 2025, high income countries are expected to generate about the same quantity of waste as today in terms of both mass and volume. Low income countries will be the largest generators of waste on a mass basis. They will also surpass the total volume of waste produced by the high income countries. The increasing percentage of plastic and paper materials in the waste stream will contribute to the growing waste volume. In the next 25 years, both low and middle income countries will experience about a three-fold increase in overall waste quantities and volumes, while those in South Korea, Hong Kong, Singapore and Japan will stay relatively constant.

Consumer societies

Industrialized countries, with only 16% of the world's population, currently consume approximately 75% of global paper production. India, Indonesia and China are three of the four most populous countries and among the lowest consumers of paper per capita. However, as their GNP and urban populations grow, paper consumption and related packaging wastes will also increase. If they follow industrialized countries, their paper requirements will be enormous.

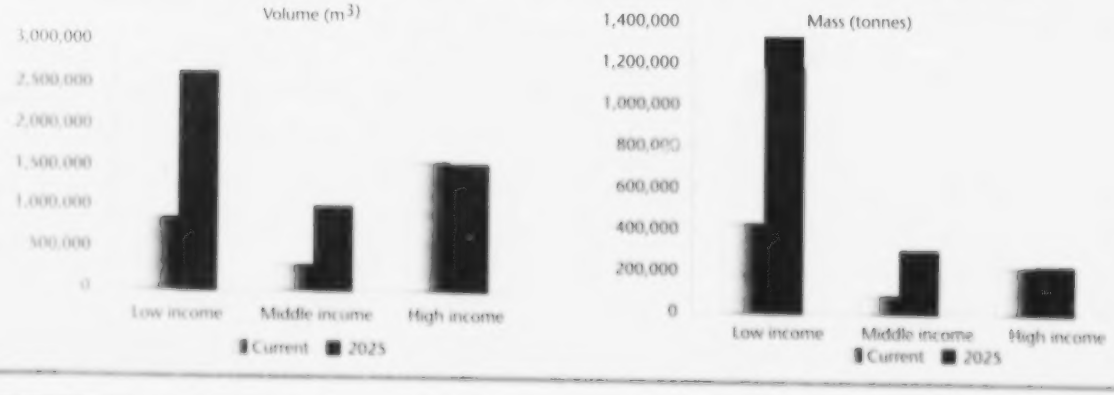
As countries become richer and more urbanized, their waste composition changes. The substantial increase in the use of paper and paper packaging is probably the most obvious change. The next most significant change is a much higher proportion of plastics, multi-material items and "consumer products" and their related packaging materials.

More newspapers and magazines (along with corresponding increases in advertising), fast-service restaurants, single-serving beverages, disposable diapers, packaged foods and mass-produced products are all by-products of widespread increases in local "disposable incomes." A negative side of greater affluence is that it brings with it more waste, in greater volumes (making it more expensive to collect). Increased use of plastic waste and food packaging often results in an increase in the amount of litter.

The rate of change in MSW quantities and composition in Asia is unprecedented. As lifestyles rapidly change, the related conveniences and products – mobile phones, electronics, items made of polyvinyl chloride (PVC) plastic, disposable diapers – pose special waste disposal challenges. Even more problematic is the fact that in most low and middle income countries, development of waste management systems woefully lags behind the realities of a quickly changing waste stream.

In addition, newly mobilized consumers and their market-savvy suppliers rarely consider the potential waste management problems that go hand in hand with changing lifestyles. The Coca-Cola Company is one telling example of how a multinational company may endeavour to increase its market share. In its 1996 Annual Report, Coca-Cola reported to shareholders that two of its four key objectives were to increase volume and expand its share of beverage sales worldwide by "investing aggressively to ensure our products are pervasive, preferred...." In another part of the report the president of the company was quoted as saying, "When I think of Indonesia – a coun-

Figure 5
Total waste quantities and volumes generated by low, middle and high income countries (per day)



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try on the Equator with 180 million people, a median age of 18 and a Moslem ban on alcohol – I feel I know what Heaven looks like." If the per capita consumption of single serving beverages increased by just one serving a month in China, India and Indonesia, 26 billion containers would be added to the waste stream (Figure 6).

Business involvement in waste management

In pursuit of expansion, multinational corporations with global marketing progammes undoubtedly change and increase the overall waste stream. On the positive side, many of the larger ones – such as McDonald's, Coca-Cola and Unilever – often have progressive progammes that address their specific, as well as the overall, waste stream.

By contrast, local firms (e.g. bottled water vendors in Indonesia) are often even more prolific waste generators than their international counterparts. However, the larger multinational companies, with their global expertise, can also become powerful allies to local governments in the fight against waste. Governments are increasingly realizing that they cannot handle waste management alone. To respond to the call, many progressive companies are working as equal partners with governments in developing comprehensive waste management progammes. A few examples of this enhanced business involvement include extended product responsibility, environmental labelling, waste exchanges and greater use of secondary materials.

This is a logical response by industry; they should get involved in waste management planning as soon as possible. Traditionally, local governments pay for waste disposal. But in Asia, with the tremendous increased volumes expected and their corresponding costs, local governments may not automatically agree to continue to pay for these services. They may try to apportion far more of these costs directly to the consumer and/or manufacturer. Deposits, cost sharing, packaging specifications and product stewardship may be preferred management options for local governments.

Solid waste management suggestions

To help solid waste management practitioners, a few "suggestions" can be proposed:

1. Developing waste disposal facilities such as landfills and incinerators often generates tremendous concern – both warranted and reactionary. However, it is possible to reduce opposition to new facilities by involving the community, following a technically sound and transparent site selection process and, wherever possible, using local conditions to ameliorate potential environmental impacts and costs, e.g. siting landfills in geotechnically superior locations. Waste disposal facilities, which often have a useful life in excess of 25 years, need to be well integrated within a sound master plan that reflects regional requirements, standard operating procedures and financing mechanisms. Sound technical justification and transparent planning processes that respect the general public's valid concerns may not eliminate public opposition, but are the best way to minimize it.

2. Local governments should minimize residential waste collection frequency to a maximum of twice per week, which is adequate from a public health perspective but requires social acceptance. Citizens should be encouraged to place their waste in containers that enhance collection efficiency.

3. Local governments should focus primarily on residential waste collection, especially waste from poor and densely populated areas, and empower the private sector to pick up waste from non-residential sources. Commercial, institutional and industrial waste collection can usually be self-financing. Local governments should license private haulers, to generate revenues and to ensure proper collection and disposal.

4. Municipalities should charge for waste disposal, and possibly collection, based on generation rates. Direct user charges and waste fee collection should begin with the business community.

5. An integrated approach to solid waste management needs to be followed. Municipal waste managers should opt for the least technically complex and most cost-effective solution (e.g. limited mechanization and incineration). Waste diversion should be maximized, and a keen awareness of waste trends is needed. For example, as mentioned above, industrialized countries now contain 16% of the world's population but use about 75% of its paper supply (Figure 7). This has a huge impact on the rapidly developing countries of Asia in terms of both overall global commodity prices and local waste disposal costs.

6. All levels of government, multinational agencies, and domestic and transnational corporations must play a role in long-term progammme development, e.g. extended product responsibility, life-cycle analysis, waste exchanges and natural resources tax regimes.

7. Local governments must honestly and respectfully gauge the public's willingness and ability to participate in the design and implementation of waste management progammes. Through good partnerships, progressive progammes can be developed in a complementary manner. These progammes include community-based operations, micro-enterprise development, waste separation for increased recycling and composting, and reduced collection frequency. Local governments usually underestimate the public's willingness and ability to participate in progressive waste management progammes.

8. All levels of government should promote the hierarchy of waste management (i.e. reduce, reuse, recycle, recover) and encourage waste separation to maximize flexibility to deal with future changes. Wherever appropriate, governments should view solid waste as a resource rather than just a "local problem".

9. Although waste collection, treatment and disposal costs often place a huge burden on local government finances, improper disposal is far more expensive in the long run, with costs accruing over many years and to many stakeholders. The urban areas of Asia now spend about US$ 25 billion on solid waste management per year; this figure will increase to at least US$ 50 billion to 2025. India's daily waste generation is about 76,000 tonnes. By 2025, this will increase to about 1.8 million tonnes. Governments need to start budgeting for these trends.

10. Local governments are usually in the best position to assume key responsibility for municipal

Figure 6
1996 per capita Coca-Cola consumption and market poulations

Market	Population (millions)	Per capita consumption*
China	1234	5
India	953	3
United States	266	363
Indonesia	201	9
Brazil	164	131
Japan	125	144
Philippines	69	117
Thailand	59	67
Korea, Republic of	45	72
Australia	18	308
Chile	14	291

8-oz servings of Company beverages per person per year (excludes products distributed by the Minute Maid company

(Coca-Cola Company, 1997)

Figure 7
Global paper consumption rates (1995)

Country	Per capita paper consumption[1] (kg/year)	Per capita GNP[2] (1995 US$)
USA	313	26,980
Japan	225	39,640
Hong Kong	220	22,990
Germany	190	27,510
United Kingdom	170	18,700
Australia	152	18,720
South Korea	128	9,700
Malaysia	62	3,890
Chile	39	4,160
Poland	31	2,790
Russia	30	2,240
Thailand	30	2,740
Brazil	28	3,640
Bulgaria	20	1,330
China	17	620
Egypt	11	790
Indonesia	10	980
Nicaragua	4	380
India	3	340
Nigeria	3	260
Ghana	1	390
Lao PDR	1	350
Viet Nam	1	240

[1] Djuweng, 1997
[2] World Bank, 1997

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solid waste collection and disposal. However, sustainable financing and sustainable service provision still need to be defined by a broader set of stakeholders. Local governments need the assistance of all levels of government to provide waste management services efficiently. Regional approaches to waste disposal (e.g. shared landfills) are especially important.

11. Generally, solid waste planners place too much emphasis on residential waste. This waste represents only about 30% of the overall municipal waste stream, but often receives the lion's share of attention. Costs also change as a country develops. For example, the amount Japan spends on waste disposal is about 10 times greater than collection costs (mostly incineration costs). Total waste management costs in low income countries are usually over 80% of collection costs. Most countries' overall costs can be minimized by:

(a) relying on landfilling, which is usually a more practical waste disposal option than incineration;

(b) focusing on organics and paper (two of the largest components in the waste stream – paper is the fastest growing in many countries). Waste managers should also concentrate on cities, since urban residents generate two to three times more solid waste than their fellow rural citizens;

(c) pursuing regional (e.g. Asia-wide, or ASEAN) approaches to many solid waste management problems, e.g. packaging regulations, product stewardship, and import/export rules.

Note

1. In this article Asia is limited to China, Japan, Hong Kong, the Republic of Korea, Mongolia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Viet Nam, Bangladesh, India, Nepal and Sri Lanka.

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Annex
Composition of urban solid waste in Asian countries

Low Income Countries

Components	Nepal	Bangladesh	Myanmar	Lao PDR	India	Sri Lanka	China	Current	Est.
1995 Urban Population (in millions)	2.9	21.9	12.2	1.1	249.1	4.1	363.7	655	1,525.70
Year	1994	1992	1993	1998	1995	1993-94	1991-95		2025
Type of Waste	MSW	Dom	Dom. Com	Dom. I C&I	MSW	Dom. Com	Dom. Com. MSW		MSW
Compostables	80	84.37	80	54.3	41.8	76.4	35.8	41.0	60
Paper	7	5.68	4	3.3	5.7	10.6	3.7	4.6	15
Plastic	2.5	1.74	2	7.8	3.9	5.7	3.8	3.8	6
Glass	3	3.19	0	8.5	2.1	1.3	2	2.1	3
Metal	0.5	3.19	0	3.8	1.9	1.3	0.3	1.0	4
Others	7	1.83	14	22.5	44.6	4.7	54.3	47.5	12

Nepal based on Kathmandu Valley.
Bangladesh based on Dhaka.
Myanmar based on Yangon.
Lao PDR based on Vientiane and Khanthabouri.
China based on Qujing, Guilin, Dalian, Wuhan, Beijing, Huangshi, Xiangtan, and Yichang.
India based on 23 metropolitan cities.
Sri Lanka based on Colombo, Kandy, and Galle.

Middle Income Countries

Components	Indonesia	Philippines	Thailand	Malaysia	Current	Est. 2025
1995 Urban Population	68.4	37.2	11.6	10.8	128	296.7
Year	1993	1995	1995-96	1990		2025
Type of Waste	MSW	n/i	n/i	n/i		MSW
Compostables	70.2	41.6	48.6	43.2	57.5	50
Paper	10.9	19.5	14.6	23.7	14.9	20
Plastic	8.7	13.8	13.9	11.2	10.9	9
Glass	1.7	2.5	5.1	3.2	2.4	3
Metal	1.8	4.8	3.6	4.2	3.1	5
Others	6.2	17.9	14.2	14.5	11.1	13

Indonesia based on Jakarta, Bandung, and Surabaya.
Philippines based on Metropolitan Manila, Batangas, Olongapo, and Baguio.
Thailand based on Bangkok, and the Municipalities of Chonburi, Rayong, Songkhla, and Chiangmai.
Malaysia based on 11 municipalities.

High Income Countries

Components	Singapore	Japan	Hong Kong	Current	Est. 2025
1995 Urban Population	3	97.2	5.9	106.1	112.3
Year	1990	1993	1995		2025
Type of Waste	MSW	n/i	Dom		MSW
Compostables	44.4	26	37.2	27.8	33
Paper	28.3	46	21.6	36.0	34
Plastic	11.8	9	15.7	9.4	10
Glass	4.1	7	3.9	6.7	7
Metal	4.8	8	3.9	7.7	5
Others	6.6	12	17.6	12.2	11

Singapore based on the entire country.
Japan based on Metropolitan Tokyo.
Hong Kong based on the entire country.

IPIECA: playing an active role in urban air quality management

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Abstract

IPIECA has developed a framework for studying air quality management in urban areas in developing countries. It sets out a process for assessing local issues, understanding problems, and evaluating strategies in order to reduce emissions and meet air quality targets. The aim of this initiative is to encourage development of practical, science-based and cost-effective approaches to help meet health-driven air quality standards.

Résumé

Pour les études sur la gestion de la qualité de l'air, IPIECA a mis au point un cadre qui peut être appliqué aux agglomérations des pays en developpement. Ce cadre propose une methode pour évaluer la situation locale, comprendre les problèmes et déterminer les stratégies qui permettront de réduire les émissions et d'atteindre les objectifs de qualité de l'air. Le but de cette initiative est d'encourager l'élaboration d'approches pratiques, scientifiques et rentables pour respecter les normes de qualité de l'air dictées par des considérations sanitaires.

Resumen

La IPIECA ha desarrollado una estructura para los estudios de gestión de la calidad eólica, aplicable en las áreas urbanas de los países en desarrollo. Pone en marcha un proceso de valoración de los asuntos locales, a través del pleno entendimiento de los problemas y la evaluación de las estrategias destinadas a reducir las emisiones y lograr la calidad de aire deseada. La finalidad de esta iniciativa es fomentar el desarrollo de proyectos prácticos, basados en fundamentos científicos y rentables que permitan alcanzar los estándares sanitarios de calidad eólica.

IPIECA is an industry association with an international membership of over 40 petroleum companies and related trade organizations. Its primary aims are to develop industry-government partnerships in order to tackle global environmental problems, and to identify practical, scientifically sound and cost-effective solutions to these problems. IPIECA currently runs programmes on oil spill preparedness and response, global climate change, biodiversity and urban air quality management. Through a Strategic Issue Assessment Forum, it also helps members identify new global environmental issues and assess their potential impact on the oil industry. These programmes are carried out in cooperation with industry, government, regulatory bodies, international agencies, academia and NGOs.

Managing urban air quality is a problem facing most cities worldwide. For many years it has received considerable attention in OECD countries. More recently, under pressure of rapid economic and social development, major cities in Asia, Latin America, the Middle East and Africa have been recognizing and addressing this problem. Work carried out in OECD countries has created a rich portfolio of experience, from which IPIECA has drawn valuable lessons. IPIECA is now actively communicating these lessons through its urban air quality management programme.

IPIECA's Urban Air Quality Management (UAQM) Programme is the medium through which the international petroleum industry collectively contributes to air quality debates. Drawing on expertise within the industry, the UAQM group has developed a framework that charts a series of step-by-step processes to assist in developing air quality management plans. The framework encourages the development of cost-effective policies to improve air quality, based on thorough and objective assessment of all emission sources.

To communicate this framework, IPIECA has visited a number of countries in Southeast Asia, culminating in an air quality workshop in Kuala Lumpur in 1997. The workshop provided an opportunity for these countries to share experiences with air quality management. Similar visits to Latin America have resulted in an ongoing partnership with the Regional Association of Oil and Natural Gas Companies in Latin America and the Caribbean (ARPEL) and participation in their air quality management programme (ARPEL/CIDA Environmental Programme, Phase 2-EMIATM).

IPIECA has produced a series of publications (IPIECA 1999, IPIECA 2000) and developed a PC-based emission forecasting model, the UAQM Toolkit. The Toolkit is designed to build emission inventory databases and help advance the search for scientifically based long-term air quality management strategies.

This article describes the principles behind IPIECA's UAQM programme and illustrates the role of the UAQM Toolkit in encouraging adoption of a structured approach to air quality management.

Principles of the IPIECA framework

Background

In 1990, IPIECA formed a "Transportation Network" of key petroleum industry representatives who recognized the importance of the companies' role in the growing global discussions on air quality problems. Shortly thereafter, an IPIECA article on "Automotive options and air quality management in developing countries" appeared in UNEP's *Industry and Environment* review as a first collective industry contribution to the debate (Saville 1993). This article highlighted the need for information exchange on the experiences of "clean vehicle" and "clean fuels" programmes, to ensure that policies being implemented in rapidly expanding cities do not replicate unsuccessful strategies carried out elsewhere.

The IPIECA Urban Air Quality Management programme was established in 1995, resulting from these earlier studies and the petroleum industry's experience with Auto-Oil programmes in Europe and the United States, Japan and other OCED countries. These Auto-Oil programmes were designed to identify optimum engine/fuel solutions to meet legislative air quality standards. More recent studies also acknowledge the need for an "integrated approach" to air quality management that considers stationary sources (i.e. residential developments, factories, power plants, etc.) as well as mobile sources of pollution from transport systems. The experience with Auto-Oil programmes was subsequently concentrated into key principles endorsed by the petroleum industry through IPIECA as essential to the development of successful air quality management programmes.

Principles

The principles of the UAQM framework include sharing experience and expertise, basing regulatory decisions on objective assessments, and ensuring that management plans are cost-effective and that emission control strategies are appropriate to local situations. These principles recognize that stakeholders must work in partner-

ship, and that all actions should be transparent and based on a process of prioritization. The principles, detailed below, form the basis of the IPIECA framework for air quality management studies:

• Sharing collective experience and expertise. Governments, and the private sector in countries that have been through the process of developing air quality management plans on a national and regional scale (and made their mistakes!), have gained a wealth of experience and expertise. This technical and management expertise can be shared with representatives from other regions who are now attempting to develop cost-effective and environmentally beneficial solutions in regard to their urban air quality concerns.

• Ensuring objective assessment. Effective regulatory planning for the management of urban air quality should be based on an objective assessment of science and technology, recognize the mix of contributing stationary, mobile and natural sources of emissions, and incorporate a process of engaging public opinion. The way in which urban air quality management programmes are fashioned, implemented and maintained can have long-term implications for a region's social, economic and environmental well-being.

• Designing cost-effective management plans. As governments and industry will be required to make considerable investments in order to realize and manage local air quality programmes, thorough cost-effective analysis should be carried out to ensure the best application of scarce resources (e.g. evaluating the cost per tonne of reduced emissions resulting from an emission reduction strategy).

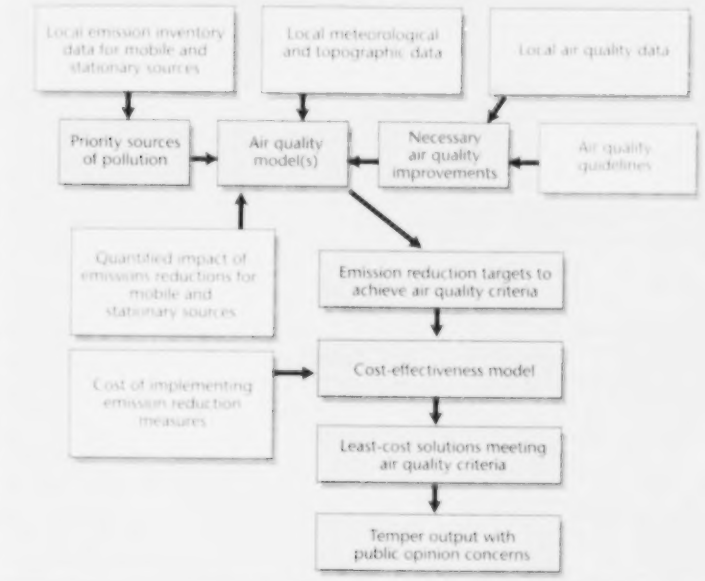
• Developing locally appropriate solutions. Air quality management strategies vary in effectiveness and costs. They may be successfully adopted in one location but not prove similarly effective in others either technically, financially, environmentally, socially or politically.

• Working in partnership. Experience has shown that developing partnerships between all stakeholders is key to the implementation of a successful urban air quality management plan. Government, industry and the public must be involved in the development of, and commitment to achieving, air quality goals. In this context, IPIECA is currently working closely with the World Bank's Clean Air Initiative, national and regional governments, academic institutions and NGOs (Box 1).

• Prioritizing issues. Air quality management plans must prioritize key issues and sources of pollutants to ensure that emission reduction strategies tackle problems in the order of their significance. For example, it has been assumed that implementing technical improvements will automatically result in less pollution. However, this assumption must consider that a reduction in emissions per source may not compensate for the growth in the number of sources, and that the sources targeted may not be the priority ones.

• Encouraging transparency and peer review. To establish and maintain the credibility of any programme, all stages should be open and transparent and the findings made available for challenge and debate. Given the wide range of interested parties, and differing levels of understanding and knowledge, this is a crucial yet difficult activity.

Figure 1
The IPIECA framework


Local emission inventory data for mobile and stationary sources
Local meteorological and topographic data
Local air quality data
Priority sources of pollution
Air quality model(s)
Necessary air quality improvements
Air quality guidelines
Quantified impact of emissions reductions for mobile and stationary sources
Emission reduction targets to achieve air quality criteria
Cost of implementing emission reduction measures
Cost-effectiveness model
Least-cost solutions meeting air quality criteria
Temper output with public opinion concerns

Creating an air quality management plan using the IPIECA framework

The flowchart in Figure 1 illustrates the key stages that constitute IPIECA's UAQM framework. The six principle stages are described below. It should be noted that the framework encourages stakeholder participation, transparency and public debate at each stage in the process.

Stage 1: The first stage is to establish the air quality targets desired for the given urban area.

Stage 2: Having established the targets, an appreciation of air quality situation and management strategies currently in place should be undertaken through monitoring and data collection.

Stage 3: The next stage requires the establishment of an emission inventory database that considers stationary, mobile and natural sources. Box 2 provides an example of how the UAQM Toolkit has assisted this process in Lima-Callao, as part of IPIECA's contribution to the World Bank Clean Air Initiative.

Stage 4: An emission inventory database, combined with socio-economic growth factors, allows forecasts to be made of future patterns in pollutant emissions. Having established future emis-

Box 1
Working in partnership – IPIECA and the Clean Air Initiative for Latin American cities

In 1998 the World Bank launched the Clean Air Initiative (CAI), targeting air quality management issues in five key cities in Latin America: Rio de Janeiro, Lima-Callao, Mexico City, Buenos Aires and Santiago de Chile. The three goals of this initiative are to

• promote integrated development or enhancement of city clean air action plans, based on participation of all relevant stakeholders;
• advance the exchange of knowledge and experience among all partners;
• foster public participation and the active involvement of the private sector in implementing innovations in the use of low-emission, low-carbon technologies.

IPIECA is working closely with the World Bank and supports the goals and objectives of the CAI initiative. In December 1999 it became a member of the CAI Steering Committee, together with the Regional Association of Oil and Natural Gas Companies in Latin America and the Caribbean (ARPEL). IPIECA is now providing the UAQM Toolkit to cities involved in the initiative.

Through capacity building programmes, IPIECA and consultants from Enstrat International Ltd. are working in close partnership with City CAI Committees, which represent both the public and private sectors. Through these programmes, the principles underlying the IPIECA framework have been communicated and considered in the development of legislation to reduce emissions to improve air quality.

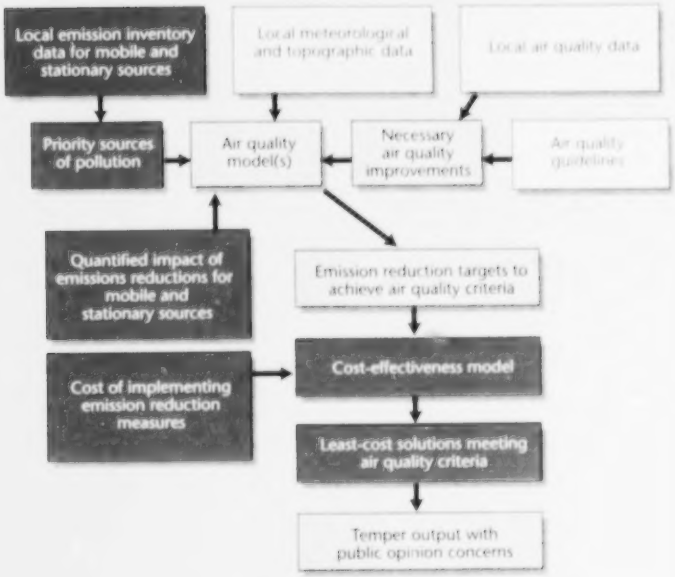
For further information, consult http://www.worldbank.org/urbi/cleanair.

sion patterns up to the target year, a comparison can be made of current air quality and the desired air quality targets, in order to establish the degree of emission reductions required and primary sources of emissions.

Stage 5: Alternative strategies, and combinations of strategies, can then be evaluated to quantify the effect they have on reducing emissions, and consequently to achieve associated improvements in air quality. Examples of emission reduction strategies for mobile source emissions include the introduction of catalysts, Euro II technologies, traffic management, fuel reformulation, and taxation on fuels, vehicles and road usage. Strategies to reduce emissions from stationary sources might include switching to cleaner fuel (e.g. natural gas), applying end-of-pipe controls such as a cyclone filter, or introducing energy efficiency measures in domestic/commercial sectors.

Stage 6: Having identified suitable strategies and combinations of strategies that meet the required reductions in emissions to achieve air quality targets, the costs associated with investing, operating and regulating each strategy need to be determined. From this, the relative cost-effectiveness of alternative scenarios can be determined and ranked. Once the most cost-effective strategies have been identified, the process of tempering the strategies with public opinion and political will can begin.

Figure 2
Stages of the IPIECA framework that can be explored using the IPIECA UAQM Toolkit (shaded in blue)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Temper output with public opinion concerns

The IPIECA Urban Air Quality Management (UAQM) Toolkit

The IPIECA UAQM Toolkit is a PC based model developed to assist in communicating and implementing the IPIECA structured approach to air quality management. It explores those steps in the framework highlighted in Figure 2 and encourages multi-stakeholder involvement and sound scientific analysis throughout the process. The UAQM Toolkit is designed as a series of Excel worksheets and is driven by equations encased in Visual Basic "add-ins".

The UAQM Toolkit has been designed to allow mobile and stationary sources of air pollutant emissions to be characterized over periods as long as 100 years, or as short as 24 hours. The characterization may be chosen to represent, and hence validate, historical conditions, and/or to project into the future to understand future trends in emissions. Forecasts of future emission trends are based on economic growth factors and energy usage. Data are entered on the energy demand from mobile emission sources (e.g. cars, motorbikes, buses, etc.) stationary emission sources (e.g. industry, domestic dwellings) and natural emission sources (e.g. crop/forest burning, volcanoes). Examples of data required in order to characterize and determine factors affecting emissions from mobile and stationary sources are shown in Table 1.

The UAQM Toolkit calculates the quantity of carbon monoxide, volatile organic compounds, nitrogen oxides, particulate matter, sulphur oxides and lead released from these sources using scientifically established emission factors (see, for example, EPEFT 1995). Once the emissions of each of these pollutants are known, the user can begin to assess the priority sources of pollution that will be targeted by emission reduction strategies.

The "base case" of emissions over a chosen time frame having been established, alternative emission reduction strategies can be assessed to test the effects on one or several pollutants. The UAQM Toolkit uses established relationships to determine the effect of control strategies on emissions. To assess the cost-effectiveness of emission reduction strategies, the UAQM Toolkit determines which strategy or combination of strategies can reduce emissions to levels that meet future air quality targets at minimum cost. For each strategy, investment, operating, regulatory and welfare costs need to be established for the given urban area. An example of output from the UAQM Toolkit cost-effectiveness studies is shown in Figure 3. Using this output, a policy maker can identify strategies to reduce emissions

Box 2
Preparing an emission inventory for Lima-Callao, Peru

IPIECA and consultants from Enstrat International Ltd have been working with the Lima-Callao Clean Air Initiative (CAI) Committee, as part of the World Bank CAI initiative, since the beginning of 2000. This programme aims to develop an air quality management plan for the Lima-Callao metropolitan area. IPIECA's involvement in the programme has three phases:

1. gathering data for a preliminary emission inventory database to be used in the UAQM Toolkit;
2. running a workshop on use of the UAQM Toolkit and the review of emission inventory data;
3. providing help desk support for the development of a final emission inventory and guidance on assessing the effect of emission control strategies.

Emission data for the Lima-Callao metropolitan area were provided by representatives of the CAI Committee and reviewed by participants in the Toolkit Training Workshop in June 2000. Representatives from government ministries, the Lima and Callao City Councils, the local petroleum industry, auto associations, the World Bank and Swisscontact international consultants attended the Training Workshop.

Emission data from mobile and stationary sources were gathered for years in which data were readily available. Historical and future data profiles were then developed for the period 1970-2025, using the Toolkit's capacity to generate data based on socio-economic indicators available from several international studies carried out for Peru.

Once a finalized emission inventory database has been agreed, emission reduction strategies can be tested. Participants trained in using the Toolkit will then have a valuable forecasting and decision-making tool to assist in the development of cost-effective urban air quality management plans for the city.

Table 1
Examples of UAQM Toolkit data requirements for mobile and stationary emission sources

Source	Characterization of emission sources	Factors affecting emissions
Mobile emissions data	• Passenger car data (population, % gasoline and diesel, size distribution) • Commercial vehicles (LDV and HDV,[1] buses) • Motorcycles (2T and 4T[2]) • Vehicle lifetime and scrappage rate	• Proportion of second-hand imports • Average annual mileage and fuel consumption • Emission factors with speed and emission degradation factors • Cost data
Stationary emissions data	• Human population and energy demand per dwelling • Industrial activity, size (% thermal input) and energy demand • Power generation • Inventory of stationary source evaporative emissions	• Fuel type and properties used in domestic and industry sectors • Power generation method (method, fuel, efficiency) • Factors affecting evaporative emissions • Cost data

[1] Light duty and heavy duty vehicles.
[2] Two-stroke and four-stroke.

of hydrocarbons to a target level at least cost or, alternatively, the costs associated with maximizing reductions of emissions above the target level.

Validation of the UAQM Toolkit

IPIECA members and several agencies responsible for national air quality programmes have reviewed the capabilities of the UAQM Toolkit. These reviews highlight the value of the Toolkit for cities in developing economies that do not currently have access to emission inventory models with the capacity to evaluate potential emissions control scenarios. The World Bank, which has also reviewed the UAQM Toolkit, recognizes its value in developing comprehensive emission factor databases and calculating multiple fuel scenarios. As part of the World Bank CAI initiative, the UAQM Toolkit has been used to prepare emission inventories in Lima-Callao (Box 2) and the potential for application is being looked at in Rio de Janeiro. The UAQM Toolkit is also being used to assist World Bank studies focusing on two-stroke vehicle emission studies in Delhi and Dhaka.

The case study in Box 3 shows how the UAQM Toolkit has recently been applied by Shell Global Solutions to assess policy options to improve air quality in New Zealand. This study compared the predicted total emissions (kilotonnes/year) from the UAQM Toolkit with official figures from the New Zealand Government. The results showed that the UAQM Toolkit produced predicted values in line with official figures, with a difference of 1% for NO_x, 4% for CO and 4% for VOC.

Conclusion

To produce effective air quality management plans for rapidly expanding cities, policies need to be based on a sound understanding of all sources of emissions, be cost-effective and locally appropriate, and be achieved through the development of strong relationships between the private and public sectors.

The IPIECA framework has been developed to communicate these principles. It provides a step by step approach to guide policy-makers through a structured approach to the assessment of policy options. IPIECA is working closely with the World Bank and partners in Clean Air Initiative cities to communicate the framework through UAQM Toolkit capacity building workshops. These activities are currently focused in South America, but IPIECA is also looking to wider use in Central and Southeast Asia. The UAQM Toolkit is widely seen as a valuable tool for developing emission inventory databases and determining cost-effective emission reduction strategies to meet air quality targets.

The IPIECA UAQM Toolkit was launched in 1998, with original distribution limited to oil industry representatives in Latin America and Southeast Asia and IPIECA member companies. As part of IPIECA's programme to actively participate in urban air quality management programmes, the UAQM Toolkit is now available to non-profit organizations on request to the association's Secretariat in London.

Acknowledgements

IPIECA would like to thank Shell Global Solutions for permission to use results and graphs from their UAQM Toolkit case study paper on New Zealand. It would also like to thank Enstrat Inter-

Box 3
A new approach to emissions inventory modelling

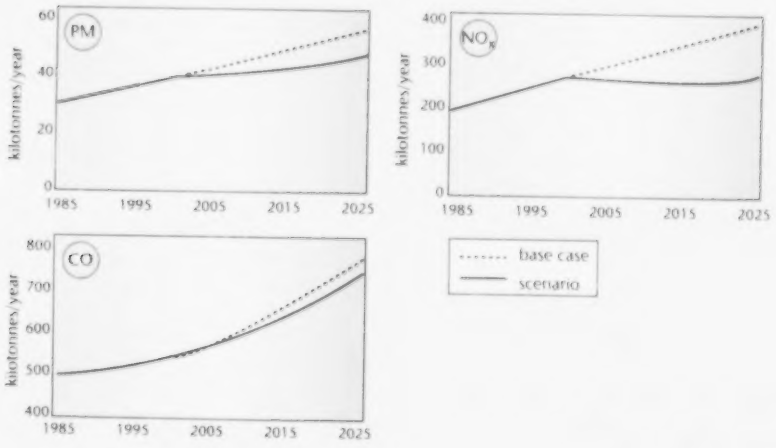
The capabilities of the UAQM Toolkit in New Zealand Shell Global Solutions have been assessed using data from the New Zealand Government and Shell New Zealand (Lilley 2000).

As part of the project, a series of 20 emission control scenarios were tested to observe their effects on PM, SO_x, NO_x, CO, VOC and CO_2 emissions up to 2025. The scenarios included changing automobile fuel specifications, introducing new vehicle technologies and traffic management initiatives, and energy efficiency programmes. Of the scenarios studied, the greatest emission reductions resulted from introducing Euro II vehicle emission limits and fuel specifications in 2001, Euro III limits in 2003 and Euro IV limits in 2005. By 2025, this would reduce PM by 21%, NO_x by 51% and CO by 25%.

Three outputs from the UAQM Toolkit are shown below. The Toolkit demonstrated that introducing Euro II emission restrictions for diesel vehicles would be the most cost-effective of the 20 strategies examined.

The study highlighted the importance of deciding whether cost-effectiveness or total emission reductions should be the driver behind air quality programmes. In this case, the scenario giving the greatest reductions was not one of the top five cost-effective scenarios. The study clearly demonstrated the UAQM Toolkit's flexibility, its strength to assess alternative emission reduction strategies in terms of cost and effectiveness, and its value as a policy-making tool.

Effect of introducing Euro II emission restrictions for all diesel vehicles from 2001 (figure courtesy Shell Global Solutions)



national Ltd and the IPIECA UAQM Working Group for their comments on this article.

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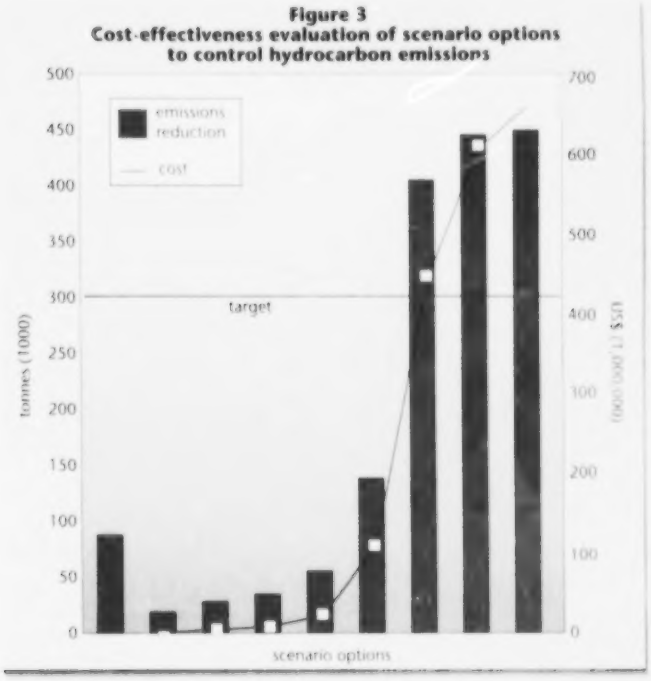
For further information about the IPIECA framework and UAQM Toolkit, contact D. Mansell-Moullin at mansell_moullin@ipieca.org or at the address shown above. ◆

Figure 3
Cost-effectiveness evaluation of scenario options to control hydrocarbon emissions



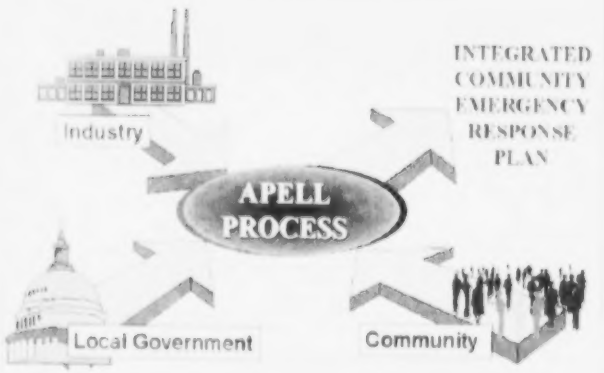
Community planning for disasters: UNEP's APELL programme

UNEP's Awareness and Preparedness for Emergencies at Local Level (APELL) programme assists disaster planning in urban areas. The APELL programme's purpose is to improve prevention of, and response to, technological accidents, especially in developing countries.

APELL provides a structured, detailed description of how to develop coordinated, integrated and well-functioning emergency response plans for local communities. These plans have two main parts: the "awareness" function (provision of information to the community) and the "preparedness" function (formulation of plans to protect people, property and the environment). Creation of an emergency response plan should involve the whole community, including industry managers, local authorities and community leaders.

Every disaster, whatever its cause, can have environmental as well as human impacts. Disaster planning is critical for urban areas, which bring together high concentrations of people with high densities of facilities that use, store or make hazardous substances. Natural disasters like storms and earthquakes can result in releases of dangerous materials from industrial and commercial sites. Sometimes major industrial accidents can be contained within the boundaries of a plant. In other cases they affect the surrounding area, with adverse short- or long-term impacts on life, property and the environment. The risks from accidents related to transport of dangerous goods by road, rail or pipeline, either through or close to populated areas, can be especially great. By definition, there is no boundary fence in such cases. The extent of the damage, particularly from accidents, depends largely on the first responders' actions at the accident scene and within the surrounding community.

Basic principles of the APELL process: communication and cooperation



Adequate response to such situations requires cooperation between various institutions and individuals. This can be achieved only if the community is aware of possible risks, and of the need for joint preparedness to cope with the consequences of accidents and disasters.

The APELL process has ten steps:

1. identify emergency response participants and establish their roles, resources and concerns;
2. evaluate hazards and risks that may result in emergency situations in the community;
3. have participants review their own emergency response plans to ensure a coordinated response;
4. identify required response tasks not covered by existing plans;
5. match these tasks to the resources of the identified participants;
6. make the changes necessary to improve existing plans, integrate them into an overall community plan and obtain agreement;
7. commit the integrated community plan to writing and obtain approval from local governments;
8. educate participating groups about the integrated plan and ensure that all emergency responders are trained;
9. establish procedures for periodic testing, review and updating of the plan.
10. educate the community about the integrated plan.

APELL as a tool for implementing Agenda 21

The importance of preventive measures to protect the environment was clearly identified in Agenda 21, particularly Chapter 19 (48), where reference is made to activities that reduce technological risks. This chapter encourages local governments to

eliminate unacceptable or unreasonable risks and, to the extent economically feasible, to reduce risks posed by toxic chemicals, by employing a broad-based approach involving a wide range of risk reduction options and by taking precautionary measures derived from a broad-based life-cycle analysis.

Among the activities recommended in 19 (49), governments should

Develop national policies and adopt the necessary regulatory framework for prevention of accidents, preparedness and response, inter alia, through land-use planning, permit systems and reporting requirements on accidents, and work with the OECD/UNEP international directory of regional response centres and the APELL programme.

A number of countries have adopted these objectives and introduced APELL as the central component of their disaster management regulations.

UNEP Technical Report No. 12, *Hazard Identification and Evaluation in a Local Community*, prepared with the help of Sweden, discusses in more detail the steps communities can take to identify the risks they face when they deal with different types of disasters. It also presents case studies and examples of risks posed by natural disasters, fires, chemical reactions and incidents that pose more than one type of risk.

For more information, contact: UNEP DTIE, 39-43 quai André Citroën, 75739 Paris Cedex 15, France; Tel +33 1 44 37 14 39; Fax +33 1 44 37 14 74; E-mail unep.tie@unep.fr; http://www.uneptie.org. UNEP Technical Report No. 12 can be ordered from SMI (Distribution Services) Ltd, Tel. +44 1438 748111; Fax. +44 1438 748844; E-mail: Enquire@SMIBooks.com

Des villes et de leur patrimoine : origines et conditions de préservation

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Abstract

How to promote both conservation and appropriate use of the urban heritage can present public authorities with difficult choices. This article, which briefly considers how cities develop, suggests ways to establish a balance between use and preservation.

Résumé

La conservation et l'utilisation du patrimoine urbain placent les responsables de la gestion des villes devant des choix difficiles. L'article ci-dessous propose un court rappel historique de la constitution des villes qui permet de dégager les conditions d'un équilibre entre l'usage du lieu et sa préservation.

Resumen

El problema de fomentar tanto la preservacion como el uso apropiado del legado urbano plantea a las ciudades alternativas complicadas. Este articulo, que presenta concisamente el desarrollo de las ciudades, estudia diversos modos de establecer un equilibrio entre el uso y la preservacion historica.

La protection du patrimoine est devenue de nos jours une activité importante de la vie des pays. C'est un enjeu politique et économique qui revient régulièrement dans les choix des dirigeants et des citoyens.

Dans les villes, la conservation et l'utilisation du patrimoine relève d'enjeux fonciers et économiques encore plus importants que dans les zones rurales. Le patrimoine urbain, parce que plus proche de nous et concentré dans des zones à forte valeur foncière, est l'objet de passions et de débats quotidiens. Son contenu a fini par déborder les monuments et palais pour englober quartiers, habitations et bâtiments commerciaux, architecture récente.

Peut-on protéger tout et faut-il le faire ? Comment garder à une ville ou à un quartier historique son caractère sans le muséifier et en respectant les besoins de confort et d'accès aux facilités modernes de ses habitants ? Comment ne pas verser dans un romantisme façadiste ? Ce ne sont que quelques-unes des questions qui se posent à chaque fois que la protection du patrimoine urbain est abordée. Pour y répondre, une rapide lecture historique de la constitution des villes et de leur patrimoine semble utile.

Jusqu'au XVIII[e] siècle, on entendait par agglomération un entassement, une concentration. C'est à partir du XIX[e] siècle que le terme commença à signifier « ville » : ce sens découle du fait d'agglomérer des habitats humains dans un même lieu. L'agglomération représente bien le phénomène urbain, issu du désir ou du besoin des humains de vivre ensemble, d'une manière rapprochée, concentrés en un même endroit. Ce besoin ou ce désir est à l'origine de la constitution des villes.

Déjà avant la première ville, les hommes avaient découvert l'utilité de vivre en groupe, en un même lieu. Depuis la période des grandes tribus de chasseurs, les menaces qui pesaient sur les humains les avaient poussés à se regrouper et à évoluer en tribus plus ou moins organisées. Progressivement, ils ont commencé à occuper des abris (grottes ou caves, failles, collines,...) et à les protéger par des enclos, à en décorer les murs de gravures ou de peintures rupestres.

C'est le développement de l'agriculture qui a entraîné, sans doute vers 8000 av. J.C., la constitution des premiers vrais villages qui ne sont plus seulement l'agglomération de quelques huttes autour d'un point d'eau. Comme l'écrit Fernand Braudel dans *Mémoires de la Méditerranée* [1] :

« L'homme est en train d'y devenir le "connaisseur des secrets qui font germer le blé et obéir l'animal", l'élevage et l'agriculture se substituent peu à peu à la chasse et à la cueillette des fruits sauvages. Du coup, l'homme s'enracine, ses villages ne bougent plus et s'élèvent sur leurs propres débris, formant aujourd'hui les collines artificielles bien connues des archéologues, les tells *d'Asie, les* magoulas *de Thessalonique, les* toumbas *de Macédoine, les* höyük *de Turquie. »*

Je voudrais retenir comme exemples des premières urbanisations deux sites archéologiques de la Méditerranée orientale.

Le premier est en Turquie : Çatal Höyük. Des fouilles archéologiques ont permis de découvrir un vrai quartier avec des habitations mitoyennes, regroupées autour de plusieurs sanctuaires. Sur l'extérieur de l'agglomération, les murs des habitations protégeaient des rôdeurs et des assaillants. Seules des fenêtres hautes, inaccessibles sans échelles, servaient sans doute à des archers pour la défense du lieu. La circulation à l'intérieur se faisait par les toits, accessibles par des échelles.

Çatal Höyük était devenue une vraie ville avec ses terres agricoles où les habitants cultivaient une grande variété de grains et d'arbres fruitiers. On y fabriquait de l'huile et de la bière et des animaux y étaient domestiqués. La ressource la plus importante de la ville restait cependant le commerce, avec un quasi monopole sur le commerce de l'obsidienne qui provenait de deux volcans en activité à sa proximité et qu'elle vendait à l'ouest de l'Anatolie, à Chypre et au Levant. En échange, Çatal Höyük recevait silex et coquillages de Syrie, et de la côte orientale de la Méditerranée, pierres, albâtre, marbre, cuivre, qui alimentaient un artisanat élaboré.

C'est surtout l'art sacré, la richesse de ses lieux cultuels qui fait la singularité de Çatal Höyük. Un matériel très riche — reliefs et peintures sur plâtre fin, la déesse de la fécondité que l'on y retrouve très souvent — pousse à croire qu'une certaine forme d'économie urbaine y était déjà assez développée pour autoriser l'utilisation d'un important surplus en faveur des sanctuaires de la ville.

C'est à la ville que l'évolution de Çatal Höyük mène : division du travail, commerce avec l'extérieur, division géographique de l'agglomération par quartiers rassemblés autour des sanctuaires, protection contre des agressions de l'extérieur. Tous les ingrédients sont là pour qu'éclose et se développe le phénomène urbain, base de notre civilisation.

Autre lieu totalement différent, autre centre de développement pré-urbain précurseur des grandes métropoles de l'Orient : Petra la nabatéenne, quasi entièrement taillée dans le grès tendre de ses montagnes et dont elle a su utiliser la topographie pour son urbanisme, ses besoins en eau et sa protection contre les agressions extérieures.

Petra est née du commerce de l'encens et a été bâtie sans doute par les tribus de la région d'Arabie du nord qui en faisaient le commerce et celui des épices entre l'Arabie Heureuse et le Monde Méditerranéen. Comme à Çatal Höyük, ici encore l'économie était plurielle : agriculture développée, ressources hydrauliques maîtrisées, artisanat, commerce florissant avec le monde extérieur, religion fortement établie. Tous les ingrédients pour assurer la durabilité de l'installation humaine dans un même lieu étaient présents. L'occupation du site de Petra s'est poursuivie sans discontinuer depuis le deuxième millénaire av. J.C. jusqu'au VIII[e] siècle de notre ère lorsque Petra a été détruite par un tremblement de terre. Entre-temps, elle a connu le sort de plusieurs autres villes : périodes

de gloire, occupations et changements de religion s'y sont succédés.

Petra est un étrange mélange de monuments concentrés dans une vallée étroite et taillés dans le grès local, avec des vestiges romains et byzantins que l'on commence à mettre à jour. La richesse de ses temples, de ses voies principales et de ses monuments funéraires, le génie et l'extrême complexité de son système hydraulique, démontrent amplement l'importance de cette concentration spatio-urbaine d'habitants ainsi que l'importance de son économie et des échanges commerciaux et culturels qu'elle a entretenus avec ses voisins. A sa façon particulière, Petra est aussi une ville.

Une ville, c'est ainsi le résultat d'une multitude de facteurs qui, combinés, fournissent les conditions nécessaires (mais pas toujours suffisantes) pour l'éclosion d'une forme de vie urbaine. Ce qui fait une ville, c'est d'abord et avant tout une économie capable de la créer et de l'alimenter continuellement. Pour qu'une agglomération, de concentration d'habitats ruraux devienne ville, il faut tous les moyens nécessaires : surplus économique, spécialisation des métiers, législation et/ou organisation sociale, religion, système politique. Combinés, ces moyens mèneront progressivement à la spécialisation spatiale : lieux de culte, espaces publics, lieux de rassemblement, lieux de pouvoir, marchés et commerces, industries, etc. Progressivement, l'espace sera modelé pour accueillir les diverses fonctionnalités qui font la ville. Des rues, des places, des avenues, assureront la communication entre ces différents espaces et sépareront en quartiers les différentes parties de la ville qui continuera à grandir aussi longtemps que son rôle économique, politique, religieux ou culturel durera.

Fernand Braudel explique fort bien ce processus de constitution des villes[2] :

« Les civilisations naissent au long de fleuves qu'il a fallu discipliner pour que se mette en place, avec l'irrigation artificielle, la saine des terres limoneuses, faciles à cultiver, d'une fertilité spontanément renouvelée. Le résultat est à la mesure de la peine : la naissance, à la fois, d'une force globale sans égale et d'une sujetion évidente des individus. Ces disciplines ne peuvent s'édifier qu'avec des réseaux de villes qui naissent des surplus agricoles de campagnes proches.

Il a fallu, en outre, pour que le dialogue inégal ville-campagne fût assuré, une certaine modernité des liens économiques, une certaine division du travail, une obéissance sociale fondée sur une religion exigeante, une royauté de droit divin. Tout cela, la religion, la royauté, le prince, la ville, le canal d'irrigation, l'écriture sans quoi aucun ordre ne peut être transmis au loin, aucune comptabilité mise en mémoire, tout cela a dû être construit à neuf.

Le reste se déduit normalement. Ces sociétés urbaines ont eu des besoins impérieux : sel, bois de construction, pierre (même la plus ordinaire). Puis, comme toute société qui se sophistique et se perfectionne, elles s'en sont créé de nouveaux qui deviennent bientôt nécessaires : l'or, l'argent, le cuivre, l'étain, l'huile, le vin, les pierres précieuses, l'ivoire, les bois rares, les parfums … Ces biens, la société riche ira les chercher au loin. Bref, l'éventail des trafics s'ouvre tôt, largement. Il y a ainsi rupture de cercles économiques qui, autrement, auraient pu se fermer sur eux-mêmes. »

Spatialement, une ville est ainsi une combinaison de constructions vernaculaires d'habitat et de commerce avec des monuments fonctionnels religieux, funéraires ou publics et des voies connectant ces éléments entre eux. L'évolution dans le temps de l'environnement urbain peut se résumer dans les dessins qui suivent. Du point de vue de l'économie, c'est un ensemble complexe d'activités allant depuis l'artisanat jusqu'au commerce et aux autres types de services et d'échanges. Une ville, c'est aussi un système économique communiquant avec son environnement pour satisfaire certains de ses besoins, notamment alimentaires et énergétiques, échangeant des services et des produits élaborés avec la production de cet environnement.

Notes

1 Ouvrage posthume publié aux Editions de Fallois, Paris 1998, pages 56 et suivantes.

2 Idem, cf. note 1.

3 Leon Krier "The Reconstruction of the European City - An Outline for a Charter", in *International Architect Magazine* (IUA), No 7, 1985.

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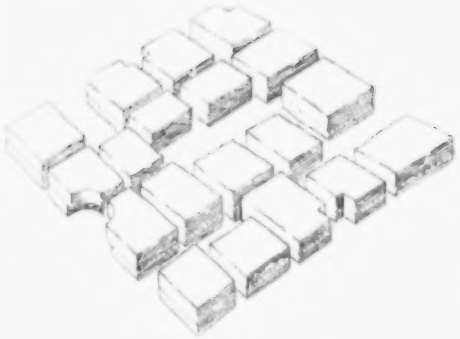
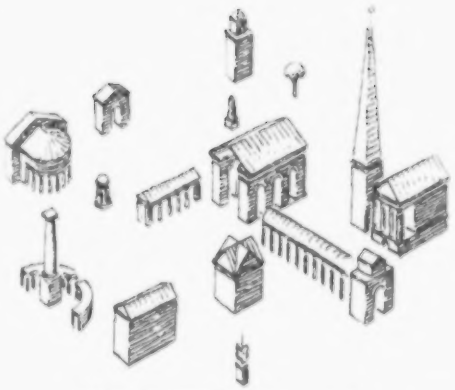
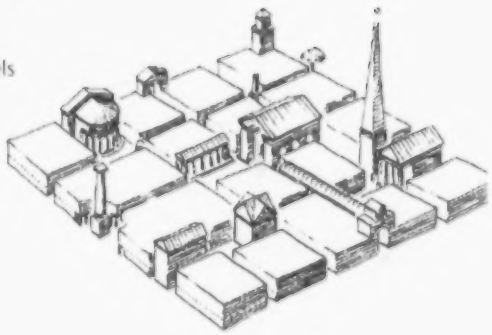


des constructions vernaculaires



+ des monuments fonctionnels



= une ville

La Alhambra y Granada: turismo y sostenibilidad

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La Alhambra y Granada se enfrentan, al igual que otros destinos de turismo cultural, al reto de integrar el turismo en el marco de estrategias innovadoras en el campo de la conservación, gestión y buen uso del patrimonio cultural. En este marco se sitúa el Estudio Previo para la Revisión del Plan Especial de la Alhambra y Alijares, cuyo marco de reflexión y de acción ha tenido como referencias básicas. La sostenibilidad turística, la toma en consideración de las motivaciones de los visitantes, la singularidad del «territorio Alhambra», la calificación de la visita en sus dimensiones culturales y de experiencia vital y la búsqueda de una modelo de relaciones amables de la Alhambra con Granada y su entorno territorial[1].

Granada en 1563-65 con la Alhambra y la Alcazaba Qadima

La singularidad del «Territorio Alhambra»

El territorio Alhambra-Alijares configura una realidad de gran complejidad y singularidad en términos urbanísticos, funcionales, paisajísticos y medioambientales. Se trata de un ámbito diferenciado físicamente, que ha conocido transformaciones diversas a lo largo de los siglos y que necesita de miradas diversas, al ser un paisaje modelado por el hombre en momentos cumbre del refinamiento urbanístico y en un emplazamiento con unas condiciones geográficas excepcionales.

La diferenciación, tanto física como simbólica, constituye uno de los pilares de su configuración como hito turístico-cultural. Se trata de un territorio de cruces y también de equilibrios precarios donde resulta fundamental su entendimiento como ciudad palaciega, diferenciada en el conjunto de la ciudad histórica. De ahí que su utilización como recurso turístico, nunca debería desvirtuar la permeabilidad secuencial por recintos.

Una lectura dinámica de la funcionalidad, desde los orígenes del conjunto monumental hasta el momento actual (ciudad real y administrativa, residencia real, espacio popular, monumento a recuperar, centro de servicios culturales y foco de atracción turística), nos ayuda a una reinterpretación de la Alhambra como una ciudad compleja y a superar el efecto negativo de una simplista lectura como palacio árabe.

La diversidad y complejidad paisajística guardan estrecha relación con las variadas formas de ocupación humana que se han ido acomodando al marco físico que las acoge, una colina alta, alargada e individualizada por la incisión profunda de los ríos Darro y Genil. El cruce de múltiples lecturas, urbanísticas, paisajísticas, funcionales, medioambientales, culturales y simbólicas, aporta las claves para construir un modelo de relaciones y de gestión válido para las necesidades de la la Alhambra y Granada en el siglo XXI.

El recinto monumental: un espacio urbano de múltiples funciones

El conjunto monumental Alhambra-Generalife y su entorno constituyen unas piezas urbanas singulares y unas realidades funcionales complejas, se diferencian físicamente de Granada pero ello no significa ausencia de relaciones. Estas relaciones han ido cambiando con el transcurrir del tiempo, pasando de ser las propias de una ciudad palatina a las de un hito turístico-cultural.

La conformación histórica del recinto de la Alhambra es el resultado de la interacción de tres funciones básicas que perduran hasta el siglo XIX: fortaleza militar, sitio real y ciudadela civil. La declaración de la Alhambra como Monumento Nacional (1870) marca el inicio de una nueva etapa en la intervención y en el uso del conjunto monumental, hasta configurarse en un hito turístico-cultural, que recibe 2.200.000 visitantes al año.

En los últimos años se han potenciado los aspectos relacionados con la función básica del monumento, en tanto que soporte material de la memoria histórica de la colectividad y de la experiencia estética de los visitantes. Esta función se despliega en cuatro dimensiones: la investigación, la celebración de eventos culturales y actividades educativas, la oferta museística y fundamentalmente la visita turístico cultural.

La Alhambra, incluida en la Lista del Patrimonio Cultural de la Humanidad (1984), es un ámbito privilegiado para la visita turístico-cultural, como lo demuestra la visita de más de dos millones de personas al año. Dentro del recinto monumental conviven actividades productivas relacionadas con el comercio turístico, la restauración y el alojamiento.

La accesibilidad y la movilidad: un ámbito de conflicto y una necesidad de racionalidad

La relación de la Alhambra con el resto de Granada sigue la tradición oriental de las ciudadelas que forman parte de una ciudad mayor. Su diferenciación física, que no aislamiento, se fundamenta en razones topográficas, urbanísticas y funcionales. Las conexiones con la ciudad se organizan a través de un eje relacionado con la funcionalidad histórica, plaza Nueva-Cuesta de Gomérez-Alamedas, y otro con la moderna funcionalidad turística, el conocido como acceso Sur.

El acceso en vehículo privado se realiza fundamentalmente por el acceso Sur y el aparcamiento del Generalife es utilizado por más de 200.000 turismos al año. Del orden de 800.000 visitantes acceden al recinto de la Alhambra en vehículo privado; los autobuses turísticos aportan del orden de medio millón de visitantes; las líneas de transporte público a la Alhambra son utilizadas por unos 700.000 viajeros al año; los taxis transportan del orden de cien mil viajeros y los flujos peatonales también son importantes, en días de máxima frecuentación son del orden de 1.500 personas las que suben andando por la Cuesta de Gomérez y unas 2.000 las que descienden.

El modelo actual de accesibilidad, solventando algunos problemas pendientes y mejorando las conexiones peatonales y urbanísticas con el entorno, puede permitir la configuración de un sistema razonable y sostenible de movilidad.

Presión turística y capacidad de acogida: los riesgos de la saturación

El conjunto de la Alhambra constituye, con cerca de 2.200.000 visitantes al año, uno de los hitos turísticos más importantes de España, estando próximo al límite de su capacidad de acogida, estimada legalmente en 2.900.000 visitantes al año.

sigue en la página 74

A nivel general la ocupación de la Alhambra está al 70% de sus posibilidades. Los días con un nivel de aforo superior al 90% se acercan a un tercio y por pases horarios, cerca de la mitad superan el umbral del 95% de ocupación.

Los Palacios Nazaríes, el hito de referencia simbólica del conjunto de la Alhambra, con una capacidad física estimada en 1998 de 444 visitantes cada media hora, son el punto de referencia de la gestión de los flujos de visitantes. Por el efecto acumulación, la presión real de visitantes se situaba en 600 personas como media a lo largo del día, y en horas punta se podían alcanzar las 800. Para no superar la capacidad de acogida, el Patronato de la Alhambra ha reducido las personas que acceden cada media hora y ha aumentado el horario de visita.

Los espacios más visitados son los Palacios Nazaríes, aunque en momentos de aforo completo se tiende a visitar todas las partes del conjunto. La mayor aglomeración se produce en las horas centrales del día, con un volumen total de visitantes acumulados en el interior del recinto monumental, en días de saturación, que puede estimarse en 4.000 personas.

El nivel medio de gasto es bastante bajo, el 46% gasta menos de y 5.000 pesetas, pero también es de reseñar que un 15% gasta más de 15.000 pesetas al día. En la Alhambra, incluyendo la entrada, el grueso de los visitantes, un 79,30%, gasta menos de 2.500 pesetas. Los visitantes valoran muy positivamente el nivel de ruido y el comportamiento de los visitantes y no se detecta una especial preocupación por el problema de la congestión.

La atención y el trato por parte del personal de la Alhambra resultan muy bien valorados, al igual que la limpieza y el estado de conservación del recinto. La valoración de la visita a los Palacios Nazaríes, a pesar de los problemas de saturación, es muy positiva, al igual que el grado de satisfacción con la visita al conjunto de la Alhambra.

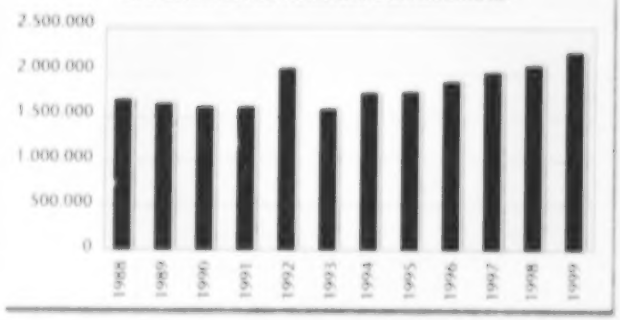
El colectivo de visitantes a la Alhambra y Granada es muy heterogéneo, en general, se corresponde con las características propias de un turismo de masas donde el factor cultural es una componente más entre las motivaciones para viajar.

Cuestiones resueltas y problemas pendientes

La gestión de un conjunto histórico, sea un recinto monumental o el centro histórico de una ciudad, es una tarea compleja y es normal que se plantee nuevas cuestiones y debates. La Alhambra no debería ser un arma arrojadiza entre administraciones y agentes urbanos con intereses, políticos o económicos, no siempre coincidentes.

La creación del actual Patronato de la Alhambra y Generalife, en 1986, ha abierto un nuevo ciclo en la compleja y, con frecuencia, conflictiva gestión del Conjunto Monumental. El Plan Especial de Protección y Reforma Interior de la Alhambra y Alijares, aprobado en 1989, ha tenido que

Evolución de los vistantes a la Alhambra



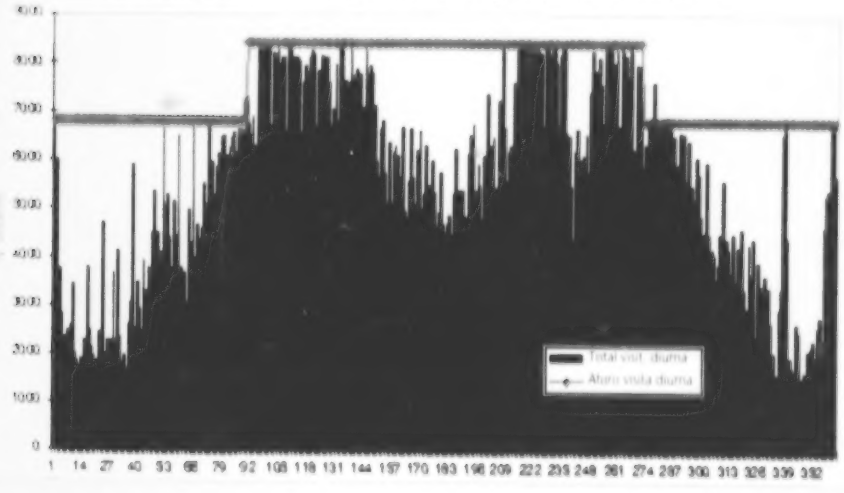
abordar, con resultado desigual, las problemáticas relacionadas con la gestión urbanística de la Alhambra y su entorno. Con independencia de pequeñas cuestiones, los problemas de acceso a la Alhambra y la regulación de tráficos y aparcamientos cuentan con las infraestructuras adecuadas.

Las acciones desarrolladas por el Patronato, rehabilitación del palacio de Carlos V, venta anticipada de entradas, audiogías, contigentación de grupos de visita, etc., han permitido reforzar la funcionalidad cultural y cualificar la visita pública. Las acciones previstas en el Plan Especial y las inversiones del Patronato en labores de investigación, conservación, restauración y rehabilitación han permitido avanzar en una línea de conservación activa, que persigue compatibilizar la visita pública, algo más de dos millones de visitantes al año, con la protección y conservación del patrimonio cultural y territorial del conjunto de la Alhambra y los Alijares.

Al turismo hay que asignarle el papel que le corresponde, al ser un motor de la economía de Granada, una ciudad con 12.000 plazas hoteleras y niveles medios de ocupación superiores al 70%, y dotarle de las infraestructuras y de los equipamientos que requiere. Los problemas funcionales del recinto monumental de la Alhambra, parte fundamental de la imagen y simbología cultural y turística de Granada, no deberían plantearse de forma aislada, ni sólo en relación con el entorno urbanístico inmediato. Se trata de una cuestión urbana mayor y por ello debe situarse en el contexto de una estrategia urbana global donde los temas relacionados con la conservación del patrimonio, la accesibilidad y la movilidad, el turismo y la cultura ocupen un lugar destacado.

Granada tiene que asumir la singularidad física, simbólica y funcional de la Alhambra y no pedir al conjunto monumental más de lo que este puede y debe dar, pues se trata de un recurso muy frágil, que por sus valores universales está bajo la tutela de la UNESCO. El Patronato de la Alhambra permite unidad de gestión y está apostando por una estrategia cualitativa, consensuada con los diversos agentes sociales; pues pedirle demasiado a la Alhambra significa aventurarse por el peligroso camino de la insostenibilidad, tanto cultural como turística.

Volumen de vistantes y capacidad de acogida (visita diurna) 1998



[1] Patronato de la Alhambra y Generalife (1999): *Estudio Previo de Revisión del Plan Especial de la Alhambra y Alijares*, Equipo Técnico: Miguel Angel Troitiño (director), Bolores Brandis, Isabel del Río, Javier Gutiérrez, Manuel de la Calle, María García, Fernando Martín, Pilar Lobo, María del Mar Alonso y Trinidad Cortés, Grupo de Investigación "Turismo y Ciudades Históricas", Departamento de Geografía Humana de la Universidad Complutense de Madrid.

"Measuring up?": implementing EMS in urban areas

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Abstract

Until recently, governments and urban areas were concerned mainly with responsible management of public funds. This did not necessarily extend to environmental issues. With the current trend towards a more environmentally responsible society, a closer look is being given to the emerging ISO 14001 standards. International cooperation increases the ability to address the growing number of common environmental problems, leading to better global solutions.

Résumé

Récemment encore, la préoccupation majeure des gouvernements et des autorités locales était la gestion responsable des fonds publics, préoccupation qui ne s'étendait pas nécessairement aux questions d'environnement. L'évolution actuelle vers une société écologiquement plus responsable a amené ces autorités à s'intéresser de plus près aux toutes nouvelles normes ISO 14001. Grâce à la coopération internationale, la capacité de faire face aux problèmes d'environnement communs, toujours plus nombreux, se développe.

Resumen

Hasta hace poco, una de las mayores preocupaciones de gobiernos y municipalidades era la gestion responsable de los fondos publicos. Sin embargo, las prioridades no se extendian necesariamente a los asuntos medioambientales. En la actualidad, la sociedad se está volviendo mas responsable en materia ambiental y tanto los gobiernos como las municipalidades tienen la vista puesta en los nuevos estándares ISO 14001. La cooperacion internacional contribuye a incrementar la capacidad para hacer frente a los numerosos problemas ambientales comunes, que a su vez permite encontrar mejores soluciones a escala mundial.

The environment is a shared legacy that requires collective solutions reached through international cooperation. Domestic actions alone are not enough to protect the health of a country's citizens. All the world's nations need to pool their efforts to ensure a healthier environment. International cooperation increases each country's ability to deal with the growing number of common environmental problems, which can lead to better global solutions.

In the next century, one of the world's largest environmental challenges will be cities and their increasing populations. Coping with the increase in urban populations will require better management of the environment and its resources. One way countries are improving their environmental performance is through implementation of Environmental Management Systems (EMS).

Good management and improved environmental performance are assets for city facilities, or any organization for that matter, in terms of building their credibility and accountability with regard to the public at large. As a result, EMS has become a widely discussed topic in environmental circles. Many businesses are now certified for the International Organization for Standardization's ISO 9000 standard and are moving towards ISO 14001 certification. The trend from ISO 9000 to ISO 14001 certification is evident in governments and urban areas around the world. They are starting to see the environmental and financial benefits of implementing an EMS, as well as the opportunities to do so.

There are numerous definitions of environmental management systems. For the purposes of this article, an EMS is defined as "a systematic approach to incorporating environmental considerations into every business decision. It provides governments with a framework for managing their environmental agendas and for tracking, evaluating and communicating environmental performance. An integral part of the overall management structure of an organization, an EMS helps ensure that major environmental risks and liabilities are properly identified, minimized and managed. The development and application of an EMS is a dynamic and continuous (life-long) improvement process and represents a long-term commitment to environmentally responsible management."[1]

EMS implementation and the bottom line

While there are health, legal and ethical reasons for implementing EMS, there is also a strong financial argument in its favour that motivates many cities to move forward in this area.

Urban area governments in their decisions in costs to the equity lower maintenance services and services. With an increasing number of global companies registered under ISO 14001, which is an internationally recognized standard, there are fewer costs for meeting different product standards. Operational duplication is reduced. These savings can then be reinvested to enhance future projects.

Studies have shown that when a business improves its corporate environmental practices, shareholder wealth increases. A company that is not at risk for environmental liabilities is more attractive to investors. Indeed, a growing number of investors are actively ruling out companies that demonstrate environmental responsibility for ethical as well as financial reasons. At the same time, a growing number of governments and urban areas, especially in the United Kingdom, are promoting the use of products from ISO 14001 certified companies.

There is also reason to suggest that an urban area encountering legal problems with a particular facility has a better chance of avoiding or reducing the probability of financial liability if it can prove it was following environmentally sound procedures such as ISO 14001.

EMS: A five phase process

There are five phases in the EMS process: commitment and policy; planning; implementation; measurement and evaluation; and review and continual improvement.

Commitment and policy are the cornerstones of a successful EMS. Initial senior management support is crucial, not only in terms of ensuring the necessary financial and human resources to take the EMS through to completion, but also in encouraging communications and enthusiasm in all parts of the urban department as it moves through to the certification process. At the Canadian Federal Department of Environment (like many other departments of the Federal Government), EMS has become an essential element of our Sustainable Development Strategy (SDS), the action plan all federal departments and agencies are required to provide to Parliament showing how they integrate environmental, economic and social considerations into policies, programmes and operations.

Before launching an EMS, a city should conduct an Initial Environmental Review (IER) to establish the performance baseline upon which it will improve. The IER is an essential foundation for planning and implementing an EMS, as it

will indicate elements of the strategy that already exist. An IER consists of a series of questions pertaining to areas of operation within a city or government department. For example, an IER can look at questions of location (environmentally sensitive areas), communication, support, environmental impacts (products, services, activities) and training. An initial environmental review can also be beneficial in determining whether employee training programmes are adequate or in need of improvement. After conducting an IER, many urban areas find they are further along the path to EMS than expected, a discovery that is both encouraging and cost saving.

Once an urban area or government decides to develop an EMS, it needs to create a thorough and detailed plan for the various stages of implementation. The plan should be sufficiently flexible not only to address future liabilities, but also to capture possible business or environmental opportunities that may arise throughout implementation. The implementation plan must be communicated to staff at all levels, clearly identifying their roles and responsibilities and ensuring that they are understood and accepted by everyone within the department. In fact, employee awareness and training are key components of any EMS implementation plan. Measures should be taken to keep staff up-to-date on the latest greening initiatives, policies and procedures, and to encourage their personal commitment to effective environmental management.

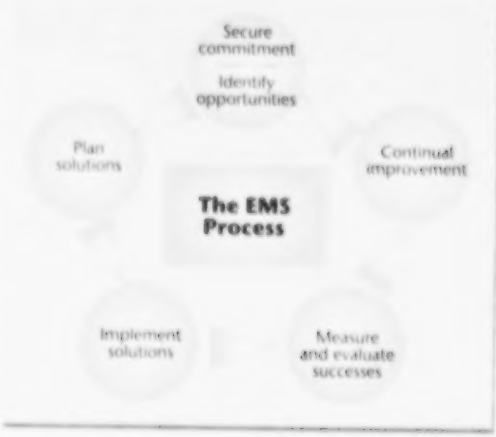
Once a plan is in place, senior management must measure and monitor the progress of implementation. Senior management refers to the person(s) who have executive responsibility for an organization, such as facility manager, regional manager, supervisor, director or mayor. This allows any adjustments to be made early on, before they become major problems. The measurement and evaluation stage is also an excellent opportunity for good news to be shared with staff. According to the ISO, a city should review and continually improve its EMS with the objective of improving its overall environmental performance.

North American context

When governments first became more environmentally responsible approximately 20 years ago, they proceeded without any real structure, often depending on the goodwill of environmentally conscious employees. This worked on an individual basis in parts of an organization, but there was not an overarching structure in place to address issues across the organization or to address all environmental issues or opportunities.

In the early 1990s the Canadian government created the Code of Federal Environmental Stewardship, which introduced more structured guidelines requiring all departments to develop environmental action plans. These plans indicated how each department would meet the commitments made in the Code and became the basis of a future environmental management system.

The Government of Canada uses an EMS, based on ISO 14004, as a tool to ensure that major environmental risks and liabilities are properly identified, minimized and managed, providing structure and consistency to the greening process. In the case of Environment Canada (EC), it ensures the consistent and diligent environmental management of all EC facilities and operations. It also helps integrate environmental considerations into overall management and planning. It improves the environmental performance of a department's operations, identifies areas of legal non-compliance, demonstrates due diligence, and ensures a management system that can be audited. Finally, it offers a structure that encourages involvement of all employees in the department's responsibilities on a day-to-day basis.



Environment Canada has the primary responsibility for administering legislation pertaining to the environment. It is also the Federal Government's technical expert on certain environmental matters. Although EC is not the leader of EMS, within the Government of Canada it is looked upon by other departments as a role model for action on environmental responsibility. For example, the Office of Federal Environmental Stewardship (1992-97) was established to coordinate, promote and facilitate adoption of the Code of Environmental Stewardship.[2] The Office also offered workshops, ranging from environmental assessment to water reduction and environmental recognition programmes. This series of workshops was open to other departments and officials from local governments. Environment Canada continues to make the information available through other courses it offers on EMS and the greening of government operations.

These workshops are one way the Federal Government of Canada can educate and influence people's behaviour and purchasing strategies. The Federal Government is one of the largest owners of land and purchasers of goods and services. This may be similar to the case in many cities. Where the government is the largest landowner, with significant purchasing power within the community, it can also have an impact on the employment market and create demand for more environmental products, services and industries. Individuals who work for the local government may be involved in decision-making processes that can affect their own work and behaviour patterns, e.g. separating waste for recycling and reducing use of electricity. These actions and others can also have a spin-off impact on the city when they leave the office.

When governments implement new policies and ways of doing business, it will have an effect on the products and services they purchase. Since many purchases will be made through local businesses, demand will be put on them to provide the necessary products. If businesses don't currently carry the products to meet these new requirements, they will educate themselves and begin to stock these goods in order to maintain their business. When the government begins purchasing with the environment in mind, this has an impact on businesses and cities that interact with them. Decisions and strategies used at one level of government can serve as an incentive and challenge to other levels, and vice versa. Over time there will be increased transfer of knowledge and information flow between the various levels of government concerning their environmental management systems.

By sharing best practices, governments can help improve employee awareness and employee involvement in the EMS process and learn from others' experiences. Although full implementation of an EMS, especially in large organizations, is a long-term commitment (approximately five to seven years), it will also produce widespread environmental and economic gains.

The US Environmental Protection Agency created a pilot project on EMS involving seven municipalities, one county and one state agency. This pilot was completed in 1997, and the EPA is working on a second one. Results show that it is feasible to apply EMS to facilities managed by local governments. An EMS is seen as an extremely useful tool for managing environmental issues, promoting compliance and pollution prevention approaches, increasing environmental awareness and stewardship, and improving operational efficiency and control. In the United States, participants in one city were able to analyze and consolidate their compliance issues to the point where only eight air quality permits were required instead of 23. This action alone saved the city US$ 16,000 per year.

Canadian urban examples

In the Canadian context, local governments are not legislated by the Federal Government. The urban managers of these departments have a responsibility for many facilities in their jurisdiction, including water, wastewater, sewage, transport and security. It may not be feasible to implement an EMS across an entire city structure at the same time, but this could be achieved on a facility or operational basis. Through a phased approach based on priority and resource levels, local governments will gradually address all issues to improve the water, air and health of the area's inhabitants.

In Canada, several local governments and urban areas have implemented an EMS. The

Regional Municipality of York, part of the greater metropolitan area of Toronto, Ontario (population 4,000,000) is aiming towards ISO 14001 registration at four of its facilities by 2001. The York-Durham Sewage System (YDSS) began the process in the summer of 1999 and plans to be registered by the spring of 2000. Once this first registration is completed, the Municipality will begin the process with the York Region Wastewater Treatment Plants, the South Urban Area (Lake Ontario) Water System and the Surface and Groundwater System.

Kitchener-Waterloo (population 433,000), a twin-city area west of Toronto, certified its Waste Management Centre in June 1998. This was the first municipal site in Canada to be registered under ISO 14001. Due to its experience with EMS implementation and certification, Kitchener-Waterloo has received many inquiries from other municipalities, both nationally and internationally, concerning the lessons learned.

The above municipalities have either certified or are in the process of certifying certain facilities. Meanwhile, Calgary, Alberta (population 843,000), is examining the possibility of certifying the entire city. Officials are in the process of looking at certification of all 13 operating entities as well as one covering the corporate level. Calgary plans to have the certification process completed between 2002 and 2004.

Through partnership arrangements, Environment Canada has been able to share the Government of Canada's experience, best practices and tools in regard to greening of government operations and EMS with various international governments, both urban and federal. For example, the Government of Canada gave a workshop in Mexico on implementing EMS at the national level. On 22 February 1999, the Mexican government released a Presidential Decree calling for the adoption of austerity and budgetary discipline, with the goal of promoting optimal and effective use of public resources. In particular, the Decree's 20th and 21st articles called for measures to increase energy efficiency and implement EMS in all departments of the Federal Government. Mexico has now taken this approach and is bringing it to state and local governments through various workshops.

In Hungary, Environment Canada worked with both UNEP IETC and South Africa's Potchefstroom University on a workshop to provide practical training concerning EMS application in urban settings. Participants included deputy mayors, senior environmental officers, municipal directors and other urban professionals from Eastern European countries. The workshop dealt with topics such as Local Agenda 21, EMS principles (history, background and policy), understanding the legal requirements of EMS, the various aspects of an IER and an environmental management programme (EMP), monitoring and measurement, training methods, networking with others from various urban areas, and international case studies. Other sessions of this course are also planned for 2000-01 in various regions of the world.

Challenges of EMS implementation

A city can face many challenges when implementing an EMS. There is an institutional challenge, as some laws prevent countries from introducing environmental clauses into procurement specifications. Budgetary challenges occur as people seek to purchase environmentally responsible items for a department within budget guidelines.

It is not always easy to integrate environmental considerations into a department's priorities. Communicating environmental priorities to various levels of decision-makers, who do not always communicate freely with each other, can be difficult. This can be accomplished through the creation of an EMS newsletter or web site, sending daily updates via E-mail or hosting workshops in the lobby so that employees have an opportunity to view the environmental changes occurring in the department. EMS implementation requires governments to become more transparent and to encourage development of a flexible workforce, open to new structures and technology. Implementing an EMS does not necessarily create extra work, but it will create a new culture and the need to find new ways of executing tasks.

In the manufacturing sector, ISO certification is applied to a particular product and its related production process – both inputs and outputs. It is more difficult to apply these principles at a government level, where the end result is not a particular product. In these cases, local and central governments could look at implementing an EMS in targeted operational areas rather than across entire departments. They should regard EMS as having many stages that can be implemented over time. For example, the Department of National Defence (DND) recently announced that it has received ISO 14001 certification for one of its Canadian Forces Supply Depot (CFSD) in Montreal, Quebec. DND hopes to certify a similar supply depot in Edmonton, Alberta, by 2002. By choosing a more gradual process for implementing certification, the department can review its progress and make any necessary adjustments.

Global examples

Environmental Management Systems, especially those structured around the concept of ISO 14001, are a global phenomenon. Between 1997 and 1998, Finland certified its Finnish Forest and Park Service, Helsinki City Transport's Bus Traffic Unit, Helsinki Metropolitan Area Council Waste Management and the Defence Force Lievestuore Depot. In the Netherlands, EMS has been in place since 1998, when the third National Environmental Policy Plan was published. Within the Dutch government, there are incentives for industries to begin EMS implementation. A company able to demonstrate the preliminary stages of EMS will in most cases encounter flexibility in licensing laws. The United Kingdom has received ISO 14001 certification for the Departments of Environment and Transport, the Regional Headquarters buildings, the Department of Economic Development's Industrial Science Centre in Northern Ireland and the Scottish Office. In Switzerland, Swisscom and Die Post have been certified.[3]

In the US in 1997, seven municipalities, one county and one state organization competed in an ISO 14001 EMS Initiative. This initiative was sponsored by USEPA's Wastewater Management and Office of Compliance. The two-year project provided small and medium-sized governmental departments the opportunity to implement an ISO 14001. Participants involved in this project were: the Town of Londonderry, New Hampshire (Department of Public Works); the City of Lowell, Massachusetts (Wastewater Treatment Facility); Wayne County, Michigan (wastewater treatment facility); the City of Indianapolis, Indiana (Department of Public Works); the Massachusetts Department of Corrections – Norfolk (state prison facility; power plant, wastewater treatment and industries); City of Gaithersburg, Maryland (Department of Public Works); Lansing, Michigan (Board of Water and Light, electricity generating facility); New York City (Metropolitan Transit Authority, capital programmes management); and the City of Scottsdale, Arizona (Department of Water Resources and Department of Financial Services).[4] These are just a few examples of governments and urban areas around the world in the process of certifying their facilities.

With the rapid urbanization cities are currently experiencing, and the projections on migration of rural inhabitants to urban centres in the next decade, cities will have to deal with increased environmental pressures and demands on limited resources. In some countries, even urban cities are amalgamating to create "megacities". There is a need to combine the numerous environmental practices, by-laws and regulations of each of these entities into a single comprehensive policy. Cities experiencing rapid urbanization will need to examine the impacts of this increased demand for housing, water, health, solid waste and other services on the environment. Sharing information and implementing a functional EMS will help urban managers address the challenges and create sustainable cities for the future.

Thoughts for the future

Communities may wonder why they should attempt to certify their facilities if this is such a lengthy and sometimes arduous task. Simply put, ISO 9000 has become a "business walk" standard and it is predicted that ISO 14001 will follow suit. Some countries are already creating legislation that will require ISO 14001 certification for doing business with them. The UK has initiated legislation stating that "5% of its departments will have at least one site registered with ISO 14001 by 2001.

Legislation of this type will also have an effect on companies and governments with which countries interact on the global stage. One way to learn more about EMS and certifying your organization or urban area is to contact UNEP IETC. You can inquire about the Application of Environmental Management Systems (EMS) Principles to Urban Management course, in which you will learn the

theory and practical sides of EMS through case studies, interacting with others in your position and talking with experts in the field of EMS.

Improving your environmental management of operations will not only reduce your environmental footprint and your costs, but also improve the overall health and well-being of your citizens.

Notes

[1] Environment Canada Atlantic Region, http://www.ns.ec.gc.ca/intcmal/green_topics/index.html.

[2] Refer to http://www.ec.gc.ca/eog-oeg for more information.

[3] See report by Elaine Geyer-Allély (OECD, 1999).

[4] Refer to document on http://www.getf.org/muni.htm.

[5] UNEP International Environmental Technology Centre, Osaka, Japan. Tel. +81 6 6915 4581; Fax +81 6 6915 0304; E-mail: ietc@unep.or.jp.

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UNEP IETC workshop: Application of Environmental Management System (EMS) Principles to Urban Management. ◆

*eco*BUDGET – local authority spending within natural limits

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Abstract

ICLEI's ecoBUDGET® environmental management system has been successfully implemented in pilot local authorities. The German city of Bielefeld, where it has been an integral part of the Local Agenda 21 process, is the first to introduce the ecoBUDGET system as a permanent administrative procedure. ICLEI has founded the ecoBUDGET Agency to support the system's further development and its introduction in other interested municipalities worldwide.

Resume

Le système de gestion de l'environnement ecoBUDGET® du Conseil international pour les initiatives en environnement (ICLEI) a été mis en œuvre avec succès par des collectivités locales à titre expérimental. La ville allemande de Bielefeld, où ce système fait partie intégrante du processus d'adoption d'Action 21 à l'échelon local, a été la première à faire d'ecoBUDGET® une procédure administrative permanente. L'ICLEI a fondé l'Agence ecoBUDGET pour soutenir le développement du système et sa mise en place par d'autres municipalités intéressées, partout dans le monde.

Resumen

El sistema de gestión ambiental ecoBUDGET® de ICLEI se ha aplicado exitosamente entre autoridades municipales piloto. La ciudad alemana de Bielefeld, donde dicho sistema se ha inscrito de forma integral en el marco de la Agenda 21, ha sido la primera en introducirlo en tanto que método administrativo permanente. ICLEI subvenciona a la agencia ecoBUDGET con el fin de promover el desarrollo del sistema y su aplicación en otras municipalidades de todo el mundo que estén interesadas.

Steering use and consumption of the local environment through *eco*BUDGET

To achieve sustainable development at a time when the capacity limits of nature and natural resources are being reached, environmental management at all levels is becoming more and more significant. Traditional planning instruments are unable to meet sustainable development needs. For that reason, strategies for sustainable development are designed at the national and international level. Local Agenda 21 processes are also taking place in many municipalities. The Local Agenda Action Plan could serve as a basis for local sustainability plans. But how to transform them and link up with other levels of government?

In cities' environmental activities certain problems often occur:

- In politics and administration, the consumption of natural resources is not seen as a central area of responsibility;
- There is no existing instrument available to politics and administrations for steering natural resource use in a systematic and planned way; and
- Dealing with environmental issues is split into isolated aspects.
- Individual environmental protection programmes and measures are implemented separately. One environmental measure can produce effects that counteract the effects of another (e.g. air pollution from waste incineration diminishes the effects of requirements for industry with respect to emissions of dangerous air pollutants.)

*eco*BUDGET offers help towards a solution of these problems, making it possible for local authorities to steer and control the use and consumption of natural resources by means of a periodic procedure and to reach a local management quality with natural resources as an integral element. *eco*BUDGET reveals areas in which measures need to be taken; other instruments such as EMAS (the EU's Eco-Management and Auditing Scheme) and ISO 14001 can be used to initiate actions to get back on course for the budget. Using indicators and time-related targets, *eco*BUDGET can be taken as the local contribution to sustainability strategies and can link different levels of government.

*eco*BUDGET was developed in the style of financial budgeting. The fundamental idea is that a municipality manages its natural resources as efficiently as the artificial resource, money.

The idea of environmental budgeting goes back to 1987, when Konrad Otto-Zimmermann, ICLEI's European Director, published an article concerning a new way to steer natural resources. Otto-Zimmermann wondered why management of natural resources should have less priority for local government than management of the artificial resource, money. Between 1996 and 2000, ICLEI (together with the German cities of Bielefeld, Dresden and Heidelberg and the county of Nordhausen) launched a pilot project to test *eco*BUDGET in practice. The project was funded by the German Federal Environmental Foundation.

To follow the "spending" of natural resources, *eco*BUDGET makes use of significant indicators, each representing the municipality's natural resources and environmental problem areas. A set of five to 20 indicators proved practical at the beginning. For each indicator, a mid-term target was agreed (five to 10 years). On the basis of the state of each resource at a certain date (reference year), it could be determined which target should be achieved in the next (and even each) year in order to achieve the agreed mid-term targets (Figure 1).

At the end of the budgetary year, the Council is given the environmental budget balance and environmental budget report, illustrating progress towards the targets. Brief "controlling reports" are drawn up in the course of the budget year to indicate emergencies. If negative deviations occur (i.e. unbudgeted expenditures), measures are to be agreed so as to balance these "ecological debts".

Advantages are also evident for investors and developers, who can make use of the budget information in their planning. Within the scope of Local Agenda 21, commitments by business and individuals can affect the municipality's sustainability targets.

Figure 1
The environmental budget cycle

Introduction of *eco*BUDGET in Bielefeld

Bielefeld is the first city that has committed itself politically to introduce *eco*BUDGET as a permanent procedure in its administration. Beforehand, only the county of Nordhausen had introduced the system for managing its natural resources.

The considerations for introducing local environmental budgeting in Bielefeld go back as far as 1995. Following an in-depth examination of the project, the City Council's Policy and Administration Committee decided in June 1997 to take part in the pilot project. In Bielefeld, local environmental budgeting was an important part of the Agenda 21 process. It was also seen as a strategic aid to target-setting in departmental planning, as was the case with implementation of the climate expert report, water provision and protection of open space.

The project started with the drafting of a provisional list of indicators, which served as a basis of discussion for further approval. In August 1997, a project team was set up within Bielefeld's local administration to work on the pilot project. It consisted of two employees of the authority and one ICLEI employee financed by the funding. Subsequently, with approval of the departments concerned, the indicators were selected according to how well they were suited to represent consumption of the "Bielefeld natural resources". Bielefeld, located in northwest Germany, has approximately 325,000 inhabitants. It is known as the "city of three landscapes" (Ravensburger Hügelland, Senne, Osning, Strang) and does have a wide range of landscape types. Of its total 260 km², at least one-third is developed land. One of its main problems is the excessive increase in developed land in recent years (approximately 60 ha/year). Among other problems is increased individual motorized transport, in which the motorway exit directly into the city centre plays a significant part.

After the 15 chosen indicators were established, values for mid-term targets for 2005 and short-term targets for the budget year of 1 August-31 July 1999 were established.

To recognize deviations from these targets as soon as possible, quarterly control values were derived. At the end of each quarter, data were compiled for most of the 15 indicators.

As a rule, existing data were used. However, a few data collection actions were carried out to support the environmental budget balance. (Two investigations ascertained river water quality and carried out a digitalization of land area for greenfield substitution measures.)

Intensive exchanges with the other pilot municipalities – Heidelberg, Dresden and the county of Nordhausen – and with the members of the advisory board (the German Federal Environmental Agency, the Association of German Cities and Wuppertal Institute, among others) made a methodical refinement of the indicator set possible.

Subsequent to the budget balancing period (i.e. after 31 July 1999), evaluation of the trial phase occurred. The results were communicated to the responsible departmental council committee in the form of a report.

One important aspect of the *eco*BUDGET procedure is co-operation between departments, enabling a comprehensive overview of the available resources and activities that affect them. The main effort during the introduction of *eco*BUDGET in Bielefeld was involving all departments relevant to the project's implementation. For this purpose, there were numerous meetings among the various departments, allowing coordination, facilitating exchange and planning the actual budget. The outcome of all consultations, as well as progress on the report, was regularly recorded and conveyed to all administrative levels, keeping staff informed and gathering support for the system.

Since August 1997, the Bielefeld project team has continually introduced local environmental budgeting to the public. As well as presentations at several Local Agenda 21 events (Bielefelder Agenda 21), with up to 80 participants, local environmental budgeting found its way into the local press (eight newspaper articles and a mention on local radio). The project was also introduced to a large circle of Agenda co-ordinators at a Local Agenda 21 event of the district government of Detmold. Specific circles in the Bielefeld economy and environmental groups were informed about the project at a common event where representatives were given the opportunity to contribute their opinions.

By the conclusion of the pilot project, environmental budgeting was very well integrated into most departments that had a direct involvement in supplying data. Data compilation was very tedious and slow at times, but to all appearances this was not due to lack of attention or wilful delays. Generally, it was a result of *eco*BUDGET tasks taking second place to obligatory duties, which were regarded as more urgent. This will be different in the future, as the Bielefeld politicians decided in the spring of 2000 to introduce environmental budgeting into the local authority.

There have been a significant number of requests from the public and decision-makers for information on environmental budgeting in Bielefeld. Practice in environmental budgeting will show the extent to which a real perception is achieved by these activities.

*eco*BUDGET as part of the Bielefeld Local Agenda 21

The basis of sustainability lies in remaining within natural limits. As environmental budgeting allows monitoring and control of natural resource use, it gives the best chance of initiating measures in reaction to unsustainable use of resources and therefore keeping within natural limits. The pro-

Table 1
Pilot Master Budget of the City of Bielefeld (extract)

No.	Indicator	Budget 1998.99		Target 2005	Origin of the set target
		Base	Mid-term target (31.07. 99)		
1.2	number of waste disposal sites not redeveloped	302 sites (01.08. 98)	287 sites	190 sites	Target is oriented on the type of waste deposit and the requirements and feasibility of remediation. In the long term, all waste deposit sites should be remediated.
1.4	length of rivers with quality class II and better	49,070 m (1995-97)	50,000 m (1996-98)	55,000 m (2003-05)	Water quality class II is respected as a target value by the Bundesland North Rhine Westphalia (Common Ministerial Paper NRW No. 42, 3 July 1991, p. 866)
1.9	CO_2 emissions through use of fossil fuel energy per inhabitant (not including transport)	5.6 t/person/year (1996)	5.6 t/person/year	5.2 t/person/year	Council resolution to decrease CO_2 emissions by 10% by 2005 in comparison with the 1987 value (5.8 t/person/year).
3.11	change in open space	-61.1 ha (1996/1997)	- ha	- ha	In compliance with Article 1a of the BauGB (planning regulation), while extending settled areas as complementary indicator to open space, soils must be used sparingly.

issue of Local Agenda 21 – establishing guidelines, approving the local action plan, implementing measures and monitoring success – interlink [illegible] the process of environmental budgeting, namely drafting of the *master budget* and implementation of the plan and the *environmental budget balance*. In this way, *eco*BUDGET and Local Agenda 21 are mutually dependent: the Local Agenda is turned from a "playground" into a place of clear commitments. *eco*BUDGET brings broad participation. This process mainly serves the ecological "column" of sustainable existence, although the environment-benefit ratio creates the link with the socio-economic aspects. Considering that the quantity and quality of natural resources represent the limiting factors for the complete path of our society's future development, *eco*BUDGET is a step forward.

*eco*BUDGET has very clearly been part of Local Agenda 21 activities, although it differs significantly from the city's other Agenda 21 activities in its style and its ties with the administration. The majority of Agenda activities have been aimed at activating citizens, while *eco*BUDGET has had as its object the functions, decisions and measures of the administration and politics. *eco*BUDGET therefore also involved many more positions within the Bielefeld administration. The interface between these two projects was the person responsible for Agenda 21, who at the same time was the local *eco*BUDGET project coordinator. Because of this combination of roles in one person, *eco*BUDGET was always introduced and brought to discussion in the numerous talks between the Agenda 21 officer and those involved in Agenda 21 processes.

During the pilot phase, synergies between the *eco*BUDGET and Local Agenda 21 could not be proved. However, their importance will obviously increase with the decision to implement *eco*BUDGET on a permanent basis. It was not an obligatory element during the demonstration. While the working groups were mainly concerned with small-scale selective problems rather than general problem areas, the advantages of an overall management element were not recognized by everybody. At such a time as the Local Agenda Action Plan is transformed into a political programme to which the Council feels committed, it will be important to have the environmental master budget available.

The first Bielefeld master budget

The main outcome of intense discussions between the responsible departments during the pilot phase of *eco*BUDGET was the indicator system, which has a good foundation in all parts of city administration, not just in the environmental administration. The indicators and the areas they represent are shown in Tables 1 and 2.

The selection criteria for the master budget were:

- Bielefeld's natural resources;
- availability of data on resource consumption;
- data usability; and
- existence of targets for development of resources in Bielefeld.

After completing the draft of the indicators, the figures corresponding to certain indicators were established for the mid-term targets in 2005 and for the budget year 1 August 1998 to 31 July 1999. It was not possible to run the environmental balancing period parallel to the financial budget (i.e. according to the calendar year), due to the time limits of the funding. The resulting problems with regard to balancing techniques could, however, be overcome.

The "pilot budget 1998/99" comprised, apart from designation of the indicators, the August 1998-July 1999 budget. It was not always possible to estimate the initial values from 1 August (the proposed reference year being 1998), but for the pilot phase it was possible to incorporate other starting points (Table 1).

In part, the mid-term targets for 2005 were taken directly from political resolutions or established on the grounds of the technical knowledge of the local authority staff, partly in cooperation with the university. They were chosen such that no additional medium had to be introduced into the budget to reach the targets. Derivation of the targets is shown in column 6 of the pilot budget (Table 1).

In difficult cases (e.g. where no consensus was possible) the target was not settled. It was left to subsequent discussion processes to determine whether deciding on targets for these cases would be possible.

The budget targets for July 1999 were generally derived from the mid-term targets for 2005 or reasonable forecasting at the time. To recognize deviations from the targets at an early stage, "controlling values" were derived from the budget's mid-term targets. At the end of the second, third and fourth quarters a data survey was carried out for most of the 15 indicators. The only exceptions were the indicators for "river water quality" and "remediation measures", which were surveyed only once as data are collected only once a year.

For the chosen indicators, the data situation was very variable. Some data (e.g. those on waste) were collected regularly and some were unavailable or fragmentary, so that the missing figures were found through additional internal data collection for that purpose or through contracting a third party.

Data compilation was carried out with the aid of questionnaires on which the targets to be achieved were filled out. The content of the questionnaires was orientated on registration forms concerning the budget areas introduced by the Bielefeld city administration, which were to be passed on to the finance office every quarter.

The results of the data surveys showed various developments for the individual indicators. Some indicators were keeping to their planned targets, but in the case of others strong deviations were noted. Here it was clear that these controlling values had a certain early warning function.

Results of Bielefeld's first environmental budget balancing

Following the environmental budget balancing period (i.e. after 31 July 1999), evaluation of the pilot phase took place. The results showed what action needed to be taken in order to keep to the budget plan.

It was clear from the results (Table 2) that two-thirds of the indicators had developed in the forecast direction, though the degree of the trends could often have been stronger.

As planned, the amount of unremediated waste

Table 2
First Bielefeld environmental budget balance

No.	Indicator	Budget balance: Initial value (01.08.98)	Budget balance: Final value (31.07.99)	Budget (31.07.99)	Mid-term target (31.12.2005)	Distance to target index*	Evaluation
Raw materials							
1.1	amount of compost and green waste per inhabitant	63 kg/person/year	59 kg/person/year	67 kg/person/year	67 kg/person/year	-100	✖
Soils							
1.2	amount of contaminated land not redeveloped	302 sites	298 sites	287 sites	190 sites	4	✔
Water							
1.3	amount of remediation of groundwater and soil/air pollution	56 sites	54 sites	53 sites	45 sites	18	✔
1.4	length of rivers with quality class II and better	49,070 m (1995-97)	45,040 m (1996-98)	50,000 m (1996-98)	55,000 m (2003-05)	-68	✖
Air							
1.5	amount of unrecycled waste per inhabitant	202 kg/person/year	202 kg/person/year	191 kg/person/year	191 kg/person/year	0	✔
1.6	motorized personal transport as a proportion of modal split	59% (1994)	59%	59%	57%	0	✔
1.7	air pollution level 1	2.16 (1996/1997)	2.04 (7.98-2.99)	2.05	1.85	39	✔✔
1.8	air pollution level 2	1.51 (1996/1997)	1.62 (7.98-2.99)	1.48	1.36	-73	✖
Climate							
1.9	CO_2 emissions through use of fossil fuel energy, per inhabitant	5.6 t/person/year (1996)	4.7 t/person/year (1998)	5.6 t/person/year	5.2 t/person/year	225	✔✔✔
1.10	change in areas with high sensitivity to climate	0 ha (1997)	-37 ha/year	-	-	-	-
Land use							
1.11	change in settled areas	+61.1 ha/year (1996/97)	+57 ha/year	-	-	-	-
1.12	annual area of land designated as replacement for developed greenfield	7.1 ha (1997)	3.1 ha/year	-	-	-	-
1.13	change in open space	-61.1 ha/year (1996/1997)	-55 ha/year	-	-	-	-
1.14	change in extent of protected conservation areas	-0.8 ha/year (1997)	-0.3 ha/year	-	-	-	-
1.15	change in extent of landscape with high conservation function	0 ha/year (1997)	-8.7 ha/year	-	-	-	-

Key:
* Distance-to-target index. How far are we towards the target, in percentage terms?
✔✔✔ target reached or surpassed ✔✔ over 25% of the way ✔ up to 25% of the way ✖ no progress made

disposal sites (indicator 1.2) and remediation of groundwater and soil/air pollution (indicator 1.3) had decreased. However, due to the necessity of putting a large proportion of the workforce onto acute cases, the initial inclusion of as yet unremediated cases came out lower than expected.

The amount of unrecycled waste (indicator 1.5) per capita did not change during the reporting period. Therefore, the expectation that this figure would decrease was not fulfilled.

The modal split (indicator 1.6) kept to the planned value. It should be noted that the modal split value was based purely on estimates. A computer-based estimate will probably be possible during 2000.

The indicator for CO_2 emissions (indicator 1.9) clearly topped the target value. The fact that the target value for 2005 was already exceeded by over 100% is probably due to the mild winter of 1997-98 and the significant increase in the proportion of the city's electricity generated by atomic energy.

For various reasons, other indicators ran in the opposite direction to the forecast.

Concerning compostable waste (indicator 1.1), the responsible department pointed out that encouraging composting at home could have led to the reduction of collected green waste. It should be reconsidered whether the 2005 target value for compostable waste will be retained, as home composting is seen as a positive development.

River water quality (indicator 1.4) did not stick to the 1998-99 budget. Instead of an increase in the length of river with high quality water, this value showed a decrease. Here the deteriorating values were probably due to weathering and possibly the variable measurements the quality.

The air pollution indicators (indicators 1.7 and 1.8) either fell short of or overshot the targets. Because these indicators are strongly dependent on weathering, the initial deviations of the values, without data for spring and summer, cannot yet foretell an overall deviation from the targets by the end of the budget year. This evaluation needs data for all the seasons.

Even without the specified targets, the land use indicators still have some interesting aspects. For areas with high sensitivity to climate (indicator 1.10) there was a significant decrease. From the figures for settled areas (indicator 1.11) and open spaces (indicator 1.13), it can clearly be seen that the change from open space to settled land has remained similar over the last few years. The amount of land designated as replacement for developed greenfield is equal to about 5% of that which has been turned into settled land.

In completion of the *environmental budget balance*, a *statement of environmental assets* and an *environment-benefit ratio* were worked out alongside the annual accounts. The environmental budget balance was approved by the departments and distributed to interested persons, although not formally agreed on by the politicians.

ecoBudget in routine practice

Part of the city administration was made sensitive to ecoBUDGET procedure and a larger part of the deciding bodies were made familiar with the instruments. The Council supported the project. However, the process of refining Local Environmental Budgeting and adapting it to local conditions has not yet been finalized.

Once the Bielefeld City Council's Policy and Administration Committee had unanimously agreed to introduce local environmental budgeting as a permanent process within the municipal government, its refinement and installation into the existing administration structures could begin immediately.

Of the other participants in the German Environmental Budgeting Pilot Project, the county of Nordhausen also decided to continue using ecoBUDGET on a regular basis in steering natural resource consumption. The decisions of the Councils of Dresden and Heidelberg are pending.

To support municipalities interested in ecoBudget, ICLEI has set up the ecoBudget Agency. It will aid with information and the introduction of ecoBudget through networking, exchange of experiences, training, certification and consultation. Contact: ecoBudget Agency, ICLEI European Secretariat, Eschholzstr. 86, D-79115 Freiburg, Germany. E-mail: ecobudget@iclei-europe.org. Please visit our website: http://www.ecobudget.com/.

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Martin Enderle, Councillor of the City of Bielefeld, is the initiator and person responsible for ecoBUDGET. Volker Stelzer, an independent environment expert, has been an ICLEI expert for ecoBUDGET in Bielefeld during the pilot project. ◆

Balanced plant nutrition may help reduce pesticide use by improving tea plants' resistance to fungal diseases

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Abstract

Increasing efforts are being made to minimize pesticide use as a basic approach to controlling pest and disease incidence in tea and other plants. In China, where the soil is frequently deficient in potash, applying adequate amounts of this nutrient could help reduce the need for pesticides. Lower rates of infestation of tea plants by fungal disease in response to potassium added to the soil has been demonstrated.

Résumé

Pour lutter contre les parasites et les maladies qui ravagent le thé et d'autres plantes, on s'efforce de plus en plus de réduire l'utilisation de pesticides. En Chine, où le sol présente souvent une carence en potasse, un apport suffisant de cet élément nutritif pourrait permettre une utilisation moins importante de pesticides. En effet, il a été prouvé que l'apport de potasse dans le sol permet une diminution du taux d'infestation du thé par les maladies fongiques.

Resumen

Cada vez prosperan más los esfuerzos para evitar el uso de pesticidas como solución generalizada para el control de plagas y enfermedades en el té y otras plantas. Aplicando al suelo la cantidad adecuada de potasa en China, que suele ser pobre en este nutriente, se puede paliar la necesidad de emplear pesticidas. También ha quedado demostrado que, al añadir potasio al suelo, se reduce el índice de plagas fúngicas en la planta del té.

Fertilization affects not only the growth and metabolism of plants, but also their susceptibility to pathogens. In a study, pot experiments were conducted to evaluate the relationship between potassium (K) application and tea plants' resistance to three widespread fungal diseases (Figures 1–3). Young tea seedlings were grown in soil supplemented with K applied at different rates. They were inoculated with spores of *Gloeosporium theaesinensis* (anthracnose), *Guignardia camelliae* (brown blight) and *Pestalotiopsis theae* (grey blight).

Results show that increased K reduced the occurrence of all three fungi. At 36 days after inoculation (DAI), the number of leaves infested by *G. theaesinensis* in the treatment with K was 2.8 times lower than in the control group. Using a soil/quartz sand mixture as substrate, the *P. theae* infestation rate was reduced by 33.3% and 53.8% when K was applied at rates of 106 and 212 mg kg^{-1}, respectively. Under the same conditions, *G. camelliae* infestation rates decreased by 39.4% and 42.6% (K_1 and K_2 application rates). Reduced tea plant infestation by fungal disease in response to K may be attributed to increased polyphenol content in plants receiving sufficient amounts.

Tea is cultivated under a variety of climatic conditions in tropical, subtropical and temperate areas. The high humidity and warm temperatures required for tea production also provide favourable conditions for the spread of disease. Anthracnose, grey blight, brown blight and other widespread diseases are responsible for considerable productivity loss every year. To control pests and diseases, which cause 10–20% of annual yield losses in China (Chen and Chen 1999), a number of pesticides are usually applied. However, depending on their toxicity, pesticides may present risks to both human health and the environment. In addition, a recent announcement that the EU is likely to recommend a further reduction of permissible critical levels of certain pesticides found in Chinese tea has alarmed growers. China exports 200,000–240,000 tonnes of tea annually.

During the past 50 years, plant protection has gone through a number of changes that might be described as occurring in three stages: total chemical control of the pest population and of disease infestation; integrated pest control based on threshold levels of attack; and, more recently, integrated pest management (IPM). IPM is considered the most sustainable, as it emphasizes plants' natural disease resistance. Adopting suitable cultivation practices is considered the basic IPM approach, with proper fertilization a crucial component. Fertilization, which has an important impact on plants' growth and metabolism, affects their susceptibility to attacks of pathogens.

Quantitatively, nitrogen is the nutrient required by tea in the greatest amounts. However, there are an increasing number of reports concerning over-application of nitrogen fertilizers that directly link this problem to increased occurrence of some diseases. For example, the widespread occurrence of anthracnose in Japanese tea plants in the last 20 years has to a large extent been attributed to excessive nitrogen input (Chen and Chen 1999).

In contrast to nitrogen, potassium generally tends to decrease plants' susceptibility to disease (Perrenoud 1990). It can be demonstrated that potassium deficiency has become a production limiting factor in China, and that K application improves both the yield and quality of different types of tea (Wu and Ruan 1994, Ruan et al. 1999). However, there is little information on K with respect to disease resistance of tea plants.

The pot experiments reported here were conducted to evaluate the relationship of K nutrition and tea plants' resistance to three fungal diseases that differ significantly in their pathway of infestation and the damage caused by the pathogen. *G. theaesinensis* (anthracnose) invades the plant by the leaf hairs located on the lower surface of younger leaves. *G. camelliae* (brown blight) invades mature and old leaves directly through the epidermis. The pathogen primarily reduces production of new shoots. *P. theae* (grey blight) is a weak parasite that invades leaves mainly via wounds and may cause serious damage, especially in areas where the tea is mechanically harvested.

In the three experiments, year-old tea seedlings of the Longjing 43 variety were transplanted to pots containing soil whose K content was adjusted using K_2SO_4, with the amounts of other nutrients (nitrogen, phosphorous, magnesium) kept at the same level in the each treatment. The treatments consisted of 18 pots per K level (a total of 54 test plants in the anthracnose experiment and 12 pots per treatment in the brown blight and grey blight experiments, equivalent to a total of 36 seedlings respectively). The tea plants were then subjected to spores of the pathogens Gloeosporium, Pestalotiopsis and Guignardia. Infestation by these diseases was recorded according to time intervals, as shown in the figures.

Effects of potassium on anthracnose infestation

Twenty-one days after inoculation (DAI), nine leaves or four seedlings showed signs of anthracnose in the -K treatment (without K application). In the +K treatment, where the plants received 250 mg kg^{-1}, no plants were affected (Figure 1). The number of leaves/seedlings infested increased rapidly with the length of the experiment. At 36 DAI, the number of leaves and seedlings showing signs of anthracnose in the -K treatment was 2.8 and three times higher, respectively, than in the +K treatment.

The strong suppression of anthracnose outbreak in the K-treated plants may be due to the low potassium level in the soil in the control treatment. This is in agreement with Perrenoud (1990), who concluded that disease suppression though adding potassium is usually confined to the K deficiency range. One reason for disease suppression could be a morphological change in the leaves, increasing their hardness and thickness, but alteration of the leaf's chemical composition could also play an important role. With low-molecular potassium substances, soluble nitrogen fractions, amides and amino acids, for example, which are usually preferred as "food" by the pathogens, were synthesized to polymeric substances such as proteins, which did not correspond to the pathogens' dietary requirements.

Effects of potassium on grey blight and brown blight infestation

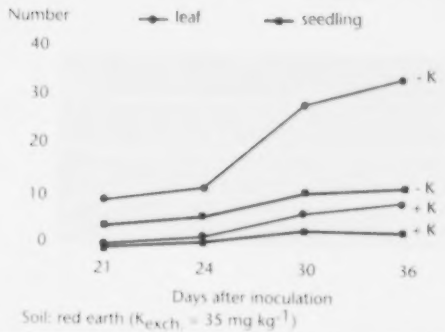
Grey blight and brown blight infestation rates increased gradually over time (Figures 2 and 3).

Grey blight's severity continued to increase until 37 DAI. At each stage recorded, infestation was significantly reduced by adding potassium. Further reduction was achieved through increasing the application rate from K_1 to K_2. The most significant effects of K in reducing grey blight infestation were observed at 37 DAI (33 and 54% reductions with K_1 and K_2 applications, respectively).

Brown blight infestation also peaked at 37 DAI. Increments became smaller after 27 DAI. At every stage, potassium application reduced the occurrence of brown blight in tea seedlings. The difference in infestation if the rate of application was increased to K_1 or K_2 was insignificant, indicating that further reduction cannot be expected once the plants are out of the K deficiency range.

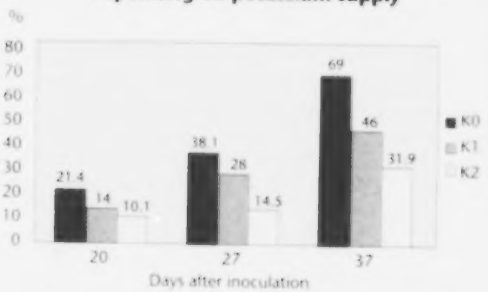
Reduced susceptibility of tea plants to fungal disease through potassium application may also be caused by enhanced synthesis of organic compounds, which could act as phytoalexins that inhibit growth and spread pathogens. Chakraborty et al. (1994) found that higher polyphenols content, in particular, may exert such antifungal effects in plants. Recent results published by Lang'at et al. (1998) confirm the close negative correlation between polyphenol content and incidence of grey blight.

Figure 1
Number of tea leaves and seedlings affected by anthracnose, depending on potassium supply



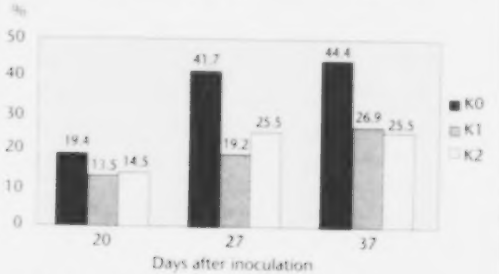
Soil: red earth ($K_{exch.}$ = 35 mg kg^{-1})

Figure 2
Rates of infestation of tea plants by grey blight, depending on potassium supply



Soil: red earth + quartz ($K_{exch.}$ = 71 mg kg^{-1})

Figure 3
Rates of infestation of tea plants by brown blight, depending on potassium supply



Soil: red earth + quartz ($K_{exch.}$ = 71 mg kg^{-1})

Our own field experiments with green tea (Ruan et al. 1999) have shown that polyphenols in tea leaves increase with K supply. The observed effects on disease suppression in tea may therefore be closely linked to the effect of potassium on the synthesis and accumulation of polyphenols.

In view of the increasing demand for green tea (due to its beneficial effects on human health), together with growing awareness of the risks presented by pesticide residues, the results of this study indicate a significant potential for integrating plant nutrition in the management of pest and diseases. This is especially important with regard to Chinese tea plant fertilization practices, where K inputs are often neglected and the emphasis is on nitrogen. In this case, the benefits for disease resistance of balancing the nutrient supply may primarily be related to potassium deficiency in the soil/plant system. Whether the effects are only confined to the K deficiency range, as stated by Perrenoud (1990), is a matter of further investigation.

Acknowledgement

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Tourism Focus

A regular section reporting on developments in the field of sustainable tourism, and on the activities of the UNEP Tourism Programme

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Roteiros de Charme Associação de Hotéis (Brazil): combining hospitality and environmental consciousness

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Abstract

The Brazilian Roteiros de Charme Associação de Hotéis, a non-profit entity grouping 30 independent hotels, inns and ecological refuges, has adopted a voluntary Environmental Code of Conduct. Besides their commitment to environmental protection, many Roteiros de Charme members also participate in projects specifically concerned with preservation of fauna, flora or cultural heritage. Information about the association and the Code of Conduct is available in English, Spanish and Portuguese on www.roteirosdecharme.com.br.

Résumé

L'association brésilienne Roteiros de Charme Associação de Hotéis, qui regroupe 30 hôtels, auberges et refuges écologiques indépendants, a adopté un code de conduite volontaire pour la protection de l'environnement. Outre leur engagement de protéger l'environnement, de nombreux membres de l'association participent également à des projets spécifiques de préservation de la faune, de la flore ou du patrimoine culturel. Des renseignements sur l'association et son code de conduite sont disponibles sur Internet en anglais, espagnol et portugais : www.roteirosdecharme.com.br.

Resumen

Roteiros de Charme Associação de Hotéis, organización brasileña de fines no lucrativos que reagrupa a 30 hoteles, hostales y refugios ecológicos independientes, ha adoptado voluntariamente un Código de Conducta Ambiental. Además de comprometerse a proteger el entorno, muchos de sus miembros participan en proyectos específicos de preservación de la fauna, la flora o el legado cultural. Encontrará información sobre la asociación y el código de conducta en inglés, español y portugués en: www.roteirosdecharme.com.br.

The resolutions adopted by the UN Conference on the Environment in Stockholm in 1972 served as the basis for environmental legislation in many countries. In Brazil, one of the first major victories came in 1985 with the creation of the *Ação Civil Pública* ("Public Civil Suit"). It was furthered by the *Código de Defesa do Consumidor* ("Consumer Defence Code"), which permitted organized social groups such as NGOs to defend their interests. The Constitution of 1988 defined the environment as an asset for the common use of the people. It invested the government with powers, and with the duty, to protect the soil, forests and seas. It also empowerered municipalities to undertake land use planning. What had previously been a federal government prerogative has therefore become a state and municipal responsibility as well.

Just as important as adequate and updated environmental legislation, usually understood in only a general way by the majority of the population, are voluntary codes of environmental conduct. These were advocated in the action plan approved by the UN Conference on Environment and Development, the 1992 Earth Summit in Rio de Janeiro. While environmental legislation is strict but not always effective, voluntary codes of conduct have proven quite efficient and have produced significant results. As adoption of such codes does not result from the coercive power of the State, but rather from the awareness and will of an enterprise and those who are part of it, their standards are more easily accepted and are not resisted as undue interference with their rights.

An example of such a programme of environmental consciousness was developed at the Hotel Roteiro dos Ventos at Teresópolis, in the State of Rio de Janeiro. This hotel (established in 1976) is perched 4000 feet above sea level in a mountainous 250-acre private park, of which 100 acres is preserved tropical forest with luxuriant foliage and a wide variety of birds. Following acquisition of the property in 1972, burning of pasture land and deforestation were totally eliminated. Since the initial planning, all construction has been restricted to existing pasture land and other areas that are already deforested, to preserve the remaining natural forest. Solar heating equipment has been used since the hotel began operating as a small inn 24 years ago. The manager and other employees are motivated to join the programme and participate in the results achieved.

This is by no means a costly social mega-programme, but a stimulus to each person's day-to-day environmental practices. It focuses on simple measures with significant practical results, such as:

- encouraging maintenance of landscaping around the homes of employees and their families who live within the property limits, with monthly prizes for the best-kept garden, chosen by themselves;
- incentives for reducing energy wastage, rewarding those who consume less than the

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average for homes of equivalent size and standard in the surrounding area;

- ♦ incentives for reducing the hotel's energy consumed through offering a prize;
- ♦ an incentive for recycling solid waste produced by the hotel, such as bottles, cardboard boxes, newspapers and non-reusable equipment, through offering financial rewards to employees;
- ♦ encouraging participation by neighbours in the recycling programme, through sharing storage at appropriate locations so that minimum quantities required by collectors are obtained;
- ♦ donation of unserviceable bed, table and bath linen to charitable institutions;
- ♦ incentives for professional advancement through provision of adequate study conditions, a work schedule compatible with school hours, and absorption by the enterprise of all or part of the educational and transportation costs of employees and their families (e.g. facilities necessary for continuing employees' education, and medical and dental care, which are in accordance with the principles of a sustainable enterprise).

Development of the Code of Conduct

Aware of the power of diffusing ideas, and of the hotel industry's responsibility to make it possible to visit environmentally and culturally important locations, I was asked to develop an Environmental Code of Conduct for the Roteiros de Charme Associação de Hotéis, using the positive experience of the voluntary environmental programme implemented at my own hotel.

The Roteiros de Charme is a private non-profit entity grouping 30 Brazilian hotels, inns and ecological refuges. The majority are in historic towns, mountain villages, resort beaches and national parks. The independent member hotels, in addition to the characteristics required by the association to which they belong, share a common awareness of the need to preserve the environment and respect nature. With the support and unanimous approval of all associates, the Environmental Code of Conduct has been adopted and is being implemented with the full cooperation of partners, managers, employees and other collaborators.

The Code was drawn up using material obtained in Brazil, as well as the excellent publications and other information supplied by UNEP's Division of Technology, Industry and Economics. Through combining this material with my professional background as a lawyer and 14 years' experience as the principal administrator of the Hotel Rosa dos Ventos, the Environmental Code of Conduct was developed.

The goal of this work is to achieve the assessment, analysis and reduction of the hotel industry's environmental impacts. Its standards recognize, in context, the local social and economic reality, operational feasibility, and the rights and expectations of our guests, without which we could not survive. It strives for a common objective, rather than conflict between environmental protection and the survival of an enterprise. There is no sustainable development without the enterprise, and consequently no employment. In accordance with these principles, some of the more radical actions which at first glance might have seemed more effective, such as "to eliminate", were replaced by "to reduce" and "to avoid" due to their unfeasibility in the present context. Actions that appear less stringent are nevertheless more easily implemented since they are more realistic. We prefer to consider as effective those environmental actions that are possible within a given cultural and economic context.

To gain the attention and elicit the interaction of guests, we have inserted the Environmental Code of Conduct guidelines in the *Guia Passaporte Roteiros de Charme* (Roteiros de Charme Passport Guide), an annual publication with a circulation of 50,000. We have included some of the practical actions taken and general information concerning our proposal to reduce water and energy consumption and solid waste generation. The Passport Guide, distributed to guests and at hotel and tourism industry events and conventions, as well as through the major sponsoring brands, is the Association's principal means of communication. As it offers loyalty prizes, the Passport Guide is more valuable than the usual publicity folder or flyer and is therefore kept.

The Code of Conduct is posted in social areas of participating hotels and supplied to guests who show an interest. It is distributed to participants in seminars and conventions held at the hotels, to better disseminate (mainly among businessmen and opinion-makers) our work and ideals with regard to a more environmentally responsible society. Information about the Roteiros de Charme Associação de Hotéis and its Environmental Code of Conduct can also be obtained (in Portuguese, Spanish and English) on *www.roteirosdecharme.com.br*.

From an exclusively business-oriented viewpoint, such dissemination is even more important in that customers all over the world make purchasing decisions and hotel choices based on environmental considerations. Close to 50 million people are affiliated to NGOs. Many more, even if they do not participate in one of these organizations, are well-informed and give preference to environment-friendly products and services.

Trials with guests and research with hotel-keepers

Prior to initiating implementation of the Environmental Code, we ran trials at hotels of different types and categories, in different regions, to test ways to disseminate the programme to guests. Individual notices or wall panels concerning the need to protect the environment did not prove sufficient to secure guests' adherence or avoid eventual dissatisfaction, even if slight, on the part of one guest or another. The most effective way to provide information, capable of persuading guests to participate and avoiding discontent, was a letter addressed to them emphasizing that, in adopting environmental conduct standards, the hotel (i) had no intention of benefitting in any way or to the detriment of guests' well-being; (ii) was being extremely careful to preserve the rights of guests and had avoided any action that could reduce the expected comfort and quality of its service; and (iii) had the exclusive intention, by informing guests of the existence of a Code of Conduct adopted by the hotel, of motivating them to participate in a programme committed to life, with the main goal of assuring the right of their children and grandchildren to natural resources that are limited and finite.

In addition to the associated hotels, we contacted managers of hotels belonging to other international associations and chains, including large luxury hotels, in an effort to

ENVIRONMENTAL CODE OF CONDUCT

For sustainable development, the fulfillment of present needs cannot compromise the needs of future generations. With this in mind, we have incorporated our Environmental Code of Conduct into The Rules and Standards of this Association, with the following guidelines:

- To ensure the participation and support of our major partners, directors and managers in the implementation of environmentally friendly practices and to involve all those who participate in, or provide services to the Company in the program.
- To identify and to mitigate environmental risks/impacts, including in planning new projects and buildings, so as to conserve local scenery, fauna and flora.
- To control and to reduce the use of products that are hazardous or unfriendly to the environment, such as asbestos, CFCs, pesticides and toxic, corrosive, infectious, explosive and flammable materials.
- To respect religious and historical sites, the host population and their cultural values and traditions.
- The conservation of energy, by eliminating superfluous lighting and, whenever possible, using alternate sources of energy, low power bulbs and automatic control equipment, such as timers, sensors and thermostats.
- The avoidance of wastage of water and the reduction of its consumption, checking for leaks, collecting and using rainwater whenever possible, and using showers, valves and equipment which allow for better control of water flow and use.
- The adoption of the 3Rs of environmental awareness: Reduce, Reuse and Recycle. The analysis of the demand for recyclable materials and of the flow of the company's solid waste, with the identification of the major components of the waste produced so as to enable adequate storage and recycling. Avoidance of the use of non-recyclable disposable products and plastic containers.
- The elimination of indiscriminate incineration of waste, burning of pastures and deforestation.
- The avoidance of leakage of any untreated sewage or of chemical products hazardous to health into the sea, rivers, springs and reservoirs. The introduction of bacteria which consume organic matter in the traditional existing cesspits and the adoption of ecological cesspits in future projects located in areas not served by public sanitation.
- The reduction of noise and air pollution, by reducing noise emissions and, whenever possible, the installation of exhaust fan filters and the substitution of refrigerating gases by others which do not affect the ozone layer.

Beyond members' commitment to the environment, many Roteiros de Charme hotels participate in projects specifically linked to preservation of fauna, flora and cultural heritage. Examples are:

• The Projeto Arara Azul, or Blue Macaw Project. The Blue Macaw (*Anodorhynchus hyacinthinus*) Project is based at the Refúgio Ecológico Caiman (Caiman Ecological Retreat), a private ecological reserve with an area of 17,290 acres. This ecotourism venture is located 1000 miles from Rio de Janeiro in the Pantanal, one of the world's major ecosystems in the State of Mato Grosso do Sul, southwestern Brazil. The Pantanal concentrates 70% of the blue macaw population, which is near extinction because of changes in its habitat and human depredation. The Caiman Inn provides accommodation and maintains the project's infrastructure.

• The Projeto Peixe-Boi, or Manatee Project. The manatee (*Trichechus manatus*; *Trichechus munguis* in the Amazon region) is the largest marine mammal threatened with extinction. The Manary Praia Hotel, 1600 miles from Rio de Janeiro in Praia Ponta Negra, State of Rio Grande do Norte, helps support the Manatee Project. It promotes lectures and seminars on environmental preservation and contributes income from the sale of products including miniatures of the animal made by the families of fishermen who used to catch the manatee and now make their living from its preservation.

Feeding a rescued manatee calf.

• The Rosa dos Ventos Hotel. To preserve the forest and its fauna and flora, construction has always been restricted to existing pasture land and other already deforested areas. The manager and other employees are motivated to join the environmental programme through prizes for reducing energy wastage and financial returns from sale of the hotel's solid waste and from recycling. Guests are encouraged to protect nature, and to birdwatch. A great variety of birds can be seen along the miles of tracks on the property. They are listed on the website.

• Historic towns in the State of Minas Gerais. The towns of Ouro Preto and Tiradentes, which played an important role in Brazil's economy and history in the 18th century, have an extremely well-preserved heritage of colonial architecture. The Pousada do Mondego, a 1747 manor house in Ouro Preto (a small town inscribed on UNESCO's World Heritage List) was acquired 50 years ago by the family of the present owners. It has taken them the better part of the last 19 years to complete its restoration. In Tiradentes, the owners of the Solar da Ponte, have devoted many years to preserving the ambiance and decor of their colonial manor house to comfortably accommodate those who come to visit the Vilas do Ouro or "Golden Villages". Both hotels are deeply involved in environmental preservation, making information available on the areas and their local fauna, flora and culture, promoting lectures on local history and culture, and organizing guided and educational tours.

identify their fears and restrictions relating to adoption of an environmental programme. We reached the following conclusions.

The great majority of hotel owners, partners and administrators lack true awareness of the fact that, besides being good for the environment, adoption of environmental practices can provide considerable financial benefits for the enterprise directly resulting from reduced consumption of electricity, water and products. They do not realize that, without interfering with the quality of the services rendered, eliminating or at least partially reducing the enormous wastage that is constantly present in our activities can considerably improve productivity and put the company in tune with the modern world.

Luxury hotel and restaurant keepers are generally afraid to adopt environmental practices that entail even optional participation by their customers. Some prefer that guests not even be informed of the existence of any environmental programme adopted by the hotel, for fear of not meeting the expectations of comfort and quality of those who are willing to pay more for service. However, the necessity of protecting the environment is an issue reported in the daily media. It is of concern to all, including the most demanding guests.

Simply letting guests who stay more than one night decide when their bath linen should be changed has resulted in an average 38% reduction of the volume to be washed. When appropriately informed, guests not only participated but even praised the hotel's initiative. No discontent or complaints arose whatsoever. All this leads us to conclude that receptivity and adherence to the environmental practices adopted depend directly on the level of information provided to guests, and not on the hotel's category, its daily rate, or the social and economic level of its customers.

Development of operational guidelines

To implement the Code of Conduct, The Roteiros de Charme took the following measures:

• It established guidelines for members' environmental quality management that initially considered their situations relative to water, sewage, garbage collection and pollution control (with few exceptions, pollution control is only carried out effectively in capital cities and other major urban areas).

• It instructed hotel-keepers to choose someone on their staff to be generally responsible for the programme and, depending on the company's structure, persons to be responsible for each of the environmental programme's core aspects: water, energy and waste. Rooms, food and beverages, housekeeping and maintenance all have impacts. Everyone uses water, consumes energy and generates waste. It is therefore necessary for the head of each administrative division to participate, in order to oversee the efforts of direct subordinates.

• It urged hotel-keepers, together with those responsible for their environmental programmes, to conduct an assessment of existing impacts. We suggested they prepare a checklist of all equipment and fixtures in rooms, bathrooms, social and service areas, gardens and swimming pool areas and ascertain eventual water, energy and product wastage.

• It disseminated, on a weekly basis, a short list of actions to be undertaken in each of the hotel's administrative divisions. Previous experience at the Hotel Rosa dos Ventos demonstrated that better results would be achieved through proposing a small number of individual actions every week, thus avoiding the risk of actions not being carried out or even of the programme being abandoned al-

together. In this Weekly Environmental Action Letter we addressed all aspects of the Code, suggesting administrative routines and measures that could be implemented. In this way we were able to propose essentially practical procedures relative to each part of the hotel, including those relating to appropriate use of electrical equipment, lighting, preventive maintenance, wastage of water, and the reduction, separation, warehousing and recycling of solid waste.

- It stimulated development of the programme's sustainability through continuous exchanges of information and suggestions between employers and employees, recording the results obtained so as to facilitate and provide a reduction of implementation costs.

Implementing and monitoring the Environmental Code of Conduct

The Association contracted a small team of recently graduated biologists, brimming with idealism and enthusiasm and led by a university professor, and prepared a three-phase plan for independent monitoring of our environmental programme. So far, the Association has covered not only most of the costs of the contracted team but also the time required and travel expenses of these and other professionals hired for the same purpose. Some associated hotels are over 1000 miles from our headquarters in Rio de Janeiro. The average cost to each hotel of the first phase (the audit) is around US$ 3000, of which the Association covers two-thirds. For the remaining phases, costs are estimated at US$ 2000 per hotel and per phase. To cover the costs, we are looking for partners and sponsors.

Phase 1: First Independent Environmental Audit

Depending on the hotel, two to three days are required for analysis of information previously supplied by the hotel and for bibliographical research; three to five days for visiting the site, evaluation of existing impacts, meetings with proprietors and administrators, and personnel training; and two to three days for preparation of a report corresponding to the basic environmental assessment arising from the on-site visit. In other words, around seven to ten days of work per hotel, in addition to travel time, which gives a good idea of the programme's scope.

The report records the environmental impacts found and suggests goals for reducing them over the short, medium and long terms, taking into account the hotel's physical and geographical situation (e.g. city, historic town, beach, mountains, environmental protection area, national park area).

Phase 2: Second Independent Monitoring Visit – follow-up and evaluation of results achieved

The second visit will occur 12 months after the first. We estimate that three to five days, plus travel time, will be necessary for the visit and preparation of the report. During the second visit, results achieved will be evaluated. Exchange of information and experience in regard to applying the Environmental Code of Conduct at other hotels will be encouraged. In addition to presentations, recycling activities and personnel training, meetings will be held with administrators. The visit will also serve to establish partnerships between the hotel and the surrounding community for purposes of promoting actions in the common interest. Within existing possibilities, partnerships will be established with local institutions, municipal authorities, local tourism, environmental and national heritage departments, community associations, NGOs, etc.

On the basis of the report of this second visit, we will attempt to establish common standards for all members of Roteiros de Charme in terms of ecological awareness.

Phase 3: Third Independent Monitoring Visit – revision of the Environmental Code of Conduct

Up to 12 months following the second visit, the third visit will take place. We estimate that between three and five days will be necessary for the visit and report. Results will be evaluated and meetings held with administrators, in addition to presentations, recycling and personnel training.

By this time, the results of the two previous phases should have demonstrated to owners and administrators not only the importance of protecting the natural and cultural heritage, but also the economic significance of adopting the Environmental Code of Conduct.

Roteiros de Charme

Dear Guest,

One of our major preoccupations, in establishing the Environmental Code of Conduct, was to assure your rights and satisfy your expectations of comfort while staying at a Roteiros de Charme Hotel, avoiding any action that could eventually lower the quality of service you have come to expect.

The softeners and other chemical products used in the laundry are highly pollutant. Absorbed by nature, they penetrate the water table, contaminating the water consumed by surrounding communities.

In leaving the decision of when your bath linen should be changed in your hands, we are not attempting, in any manner whatsoever, to obtain any benefit in detriment to your wellbeing. We only wish to avoid unnecessary washing, eventually of a towel that has not even been used, and avoid wasting water and energy.

Our purpose is exclusively to invite you to participate in our environmental preservation programme, the main goal of which is to assure the right of our children and grandchildren, the right of future generations, to finite natural resources.

Thank you very much.

Heitor Waddington
President

Based on an evaluation of the three first phases, the Environmental Code of Conduct is to be reviewed with the aim of establishing a common minimum standard for all the hotels. This minimum standard must be submitted to the Roteiros de Charme's General Meeting for approval, in accordance with its by-laws.

Continuity of the programme

The programme's duration is indefinite. It needs to be refined continuously to better meet the objective of assuring sustainable development of the tourism industry, thus promoting economic development and so reducing social inequalities in regions that depend on this industry. Experience will show the road to take.

I have frequently visited almost all the hotels, inns and ecological refuges that are part of Roteiros de Charme. They are situated in all regions of Brazil, a country of continental dimensions. Brazil is full of diversity, contrasts and social inequalities, but at the same time unique in its natural beauty and in the cheerfulness of its people, who harbour no ostensible prejudice as to race or religion.

Experience with implementing the Environmental Code of Conduct leads us to believe in the continuity of this programme, in light of the receptivity of all those who have had the opportunity to participate. This encourages us to extend our commitment, which should not limit itself to the hotel association but should also reach out to host communities.

The interactive meetings we conduct are attended by all employees, including the most lowly. In these meetings we have observed the awakening of a sense of self-esteem that apparently did not exist before, and the emergence of a desire to participate in a programme whose success also depends on them. We have been able to spread the message of environmental conservation to their families, whom we also try to include in the programme. They are astounded to learn that by pouring oil or chemicals on the soil, instead of storing them in an appropriate location, they could be contaminating the water table that supplies their relatives' houses, even when these are situated miles away; or when they realize the potential benefits of not throwing away things that could be reused, recycled or even sold, and the fact that these benefits could be even greater if the efforts of friends and neighbours were joined with their own.

All the same, respect for nature and procedures that do not harm the environment can only exist in communities enjoying education, hygiene, and (consequently) good health. There is nothing more anti-ecological than poverty and misery – that is, lack of basic human necessities. The effectiveness of environmental legislation, and of codes of conduct, directly depends on the existence of decent conditions for survival and education.

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World News

GMOs treaty adopted

In January representatives of over 130 governments met in Montreal to finalize a treaty on transboundary movement of genetically modified organisms (GMOs), one of the most high-profile and controversial international trade issues. The *Cartagena Protocol on Biosafety*, completed after five years of negotiations, addresses international shipments of living modified organisms (LMOs). Its aim is to protect the environment from potential risks posed by LMOs.

The term "biosafety" generally refers to efforts to benefit from modern biotechnology while avoiding its risks. Biosafety is based on the precautionary principle, according to which precautionary measures should be taken when an activity presents threats of serious or irreversible damage to the environment or human health, even if cause and effect relationships have not been determined with complete scientific certainty.

While industrialized countries have domestic biosafety regimes, many developing countries are just beginning to establish their national systems. Agricultural LMOs are already a multi-billion dollar global business. Pharmaceutical products derived from LMOs are the basis of an even larger, and rapidly growing, international industry.

Under the new Protocol, governments will communicate their willingness – or refusal – to accept imports of agricultural commodities containing LMOs through an Internet-based Biosafety Clearing House. Clear labelling of shipments that contain LMOs will be required. Even stricter provisions will apply in the case of LMOs to be introduced into the environment intentionally, such as seeds and live fish. Exporters of such organisms must provide detailed information to the receiving country before the first shipment is made, and importers must then authorize the shipment. These requirements are meant to ensure that recipient countries have the opportunity and the ability to assess potential risks associated with modern biotechnology.

LMOs include many different types of food crops that have been genetically modified to give them greater productivity or nutritional value, or to make them more resistant to pests or disease. Among the most common LMO crops are soybean, tomato, grains, cassava and maize (corn). Seeds are especially important, as they are used to propagate LMOs in the natural environment.

While humans have been artificially altering the genetic makeup of plants and animals for thousands of years through selective breeding and cross-fertilization, advances in biology since the 1970s have enabled scientists to radically alter living cells' genetic structure by introducing genes from one organism into the cells of another. For example, at a Swiss laboratory genes from daffodils and a bacterium have been spliced into rice to make it richer in beta carotene, the source of Vitamin A. "Golden rice", so-called for the colour the beta carotene gives it, was created with the intention of helping the estimated 124 million children worldwide who are deficient in Vitamin A. In Southeast Asia, a quarter of a million children go blind each year due to Vitamin A deficiency. Whether the altered rice loses its nutritional value or has other undesirable characteristics must still be determined.

Products such as "golden rice" demonstrate biotechnology's potential to help make advances in many areas, from increased crop yield to production of new or improved pharmaceuticals obtained through the use of genetically engineered plants and animals. However, most LMO crops developed so far are either toxic to insects or tolerant of herbicides, characteristics often perceived as benefiting seed companies more than consumers. Such LMO characteristics have created intense public concern and consumer resistance, especially in Europe and Asia.

Maize that has been genetically altered to contain high levels of the insect-killing bacterium *Bacillus thuringiensis* (Bt) has been promoted by its developers as a way to reduce pesticide use. But recent tests in the United Kingdom showing that pollen from Bt maize can spread several kilometres beyond fields where it is grown have highlighted concerns about the possibility of genetically engineered plants cross-pollinating with other plants growing nearby. In May 1999, Cornell University researchers reported that pollen from Bt maize could be fatal to monarch butterflies when dusted on milkweed, the monarch's only food during the caterpillar stage. Field studies are under way to ascertain whether the results are the same for milkweed growing wild near cornfields.

Other safety issues include the potential for unintended changes in competitiveness, virulence or other characteristics of the LMO; the possibility of adverse impacts on non-target species, such as beneficial insects, or on ecosystems; the potential for weediness in genetically modified crops (i.e. for a plant to become too resistant and invasive, perhaps by transferring its genes to wild relatives); and the possibility that inserted genes will lose their effectiveness or be transferred to another host.

Despite the controversy, LMOs have received significant support in view of their potential to improve food supplies and nutrition. The Director-General of the U.N. Food and Agriculture Organization, Jacques Diouf, supports using genetically modified plants and animals to feed an ever-expanding world population. While acknowledging that conventional crops could feed all of the world's people if evenly distributed to developing countries, he has predicted that a shortage of arable land will make it impossible to feed a population expected to peak at 9 billion without genetically engineered foods. "We cannot deprive ourselves of the potential to have crops that require less pesticide, need less nitrogen and phosphorous to grow and offer poor people improved nutrition," he has said. "We need to take all the necessary precautions to protect human health and the environment. But in the long term, I believe this is a vital tool in the fight against hunger." Although world opinion remains divided, Diouf has said he believes consensus can be achieved on LMO food standards.

The talks that led to the Cartagena Protocol's adoption were held under the Convention on Biological Diversity, whose administering body is UNEP. They followed an initial session in Cartagena, Colombia, in February 1999 that broke up without agreement due to a number of outstanding differences among participants. These differences included the scope of the proposed Protocol, liability issues, and concerns about traditional crops' market competitiveness against LMO imports. The Protocol's relationship to other international agreements, and notably to the World Trade Organization, was an additional point of contention. While environmental agreements are often premised on the precautionary principle, decisions under trade law generally require "sufficient scientific evidence".

In July and September 1999, Colombian Environment Minister Juan Mayr Maldonado, acting as President of the first session, held two rounds of informal consultations among representatives of the negotiating groups. There were major disagreements between the so-called Miami Group (Argentina, Australia, Canada, Chile, Uruguay and the United States), which called for restricted regulatory

powers, and the Like-Minded Group of Countries, which includes China and most developing countries. The latter wanted much stronger provisions. The European Union, Central and Eastern European Countries, and the Compromise Group (Japan, Switzerland, New Zealand and South Korea) took positions between those of the other two groups.

The main sticking points for negotiators were resolved when European delegates agreed that it is impossible to segregate and require labelling of bulk products containing GMOs, such as soybeans. Instead it will be specified that shipments may contain GMOs. The Miami Group, for its part, conceded that health concerns could be included in the provision of the Protocol allowing countries to reject GMOs. They had previously objected to the use of the word "health" on grounds that this issue should not be addressed in an agreement on biodiversity.

The negotiating groups ultimately worked out a compromise with regard to the Protocol and the WTO. They are to be mutually supportive. At the same time, the Protocol will not affect the rights and obligations of governments under any existing international agreements.

The agreed text of the Biosafety Protocol was opened for signature at UNEP's headquarters in Nairobi in May, on the occasion of the Fifth Session of the Conference of the Parties to the Convention on Biological Diversity. The Protocol will enter into force once 50 countries have ratified it.

The environmental organization Greenpeace praised the ministers for adopting these "minimum safety standards" and urged governments to ratify the Protocol immediately.

"The Biosafety Protocol is the first new environmental treaty of the 21st century, a century that will be dramatically shaped by biotechnology," said Klaus Töpfer, UNEP's Executive Director. "[The] agreement in Montreal empowers the international community to build an effective regime for ensuring that the planet's biological diversity will be able to coexist with this powerful technology."

The Protocol and related information are available on line at *www.biodiv.org*.

For more information, contact: Monique Chiasson, Secretariat of the Convention on Biological Diversity, World Trade Centre, 393 St Jacques Street, Office 300, Montréal, Québec, Canada H2Y 1N9. Tel: +1 (514) 288 2220, Fax: +1 (514) 288 6588, E-mail: secretariat@biodiv.org, Internet: www.biodiv.org. ◆

Italy bans weekend car use in many cities

The Italian government announced in February that use of most private cars will be banned during some weekend hours in the city centres of Rome and over 150 other towns and cities. In Rome the ban will be in effect for 10 hours on Sundays; public transportation and entry into museums and archaeological sites will be free during these hours. Other municipalities will establish their own rules and schedules. The scheme is a pilot project by municipal authorities to reduce car-related air pollution.

UNEP Executive Director and Habitat Acting Executive Director Klaus Töpfer welcomed the initiative. While acknowledging that cars are a necessity, he stressed that "the health of the people in our cities depends on balancing the demand for private vehicles with other means of public transport. Also, innovative solutions are needed that will reduce the pollution from car emissions and minimize the congestion caused by cars." According to UNEP's *Global Environmental Outlook 2000*, motor vehicles release 900 million metric tonnes of CO_2 annually. Such emissions, accounting for more than 15% of global fossil fuel-related CO_2 releases, are a major contributor to global warming.

The rapid increase in the number of cars has exacerbated problems associated with motor vehicle-related air pollution. While there were only 70 million motor vehicles in the world in 1950, mostly in Europe and North America, today there are over 500 million. Many developing countries will see the size of their fleets continue to increase. Delhi's, for example, grew by about 20% per year in the 1970s and 1980s. The total number of motor vehicles in China has almost doubled every five years in recent decades.

The increase in car-related pollution takes a heavy toll on human health. The World Health Organization (WHO) estimates that exhaust emissions cause more deaths than road accidents. A WHO study in Austria, France and Switzerland found that exposure to pollution caused some 21,000 deaths every year in the three countries, as well as 300,000 extra cases of bronchitis in children and 15,000 extra admissions to hospitals for heart disease aggravated by pollution. Severe air pollution has become one of the most notable and characteristic features of "megacities" in the developing world, affecting the health of millions of people (see "Facts and Figures" in this issue of *Industry and Environment*).

Some cities have demonstrated that balancing transport policies and improving land use planning can control the trend towards increased private vehicle use. In Curitiba, Brazil, which is perhaps the best known example, an integrated bus system in use since 1974 has resulted in 25% of commuters giving up their cars and using buses. Bangkok's new Skytrain transport system began service in December 1999. This year Athens, one of Europe's most polluted cities, inaugurated a subway system that municipal authorities hope will reduce air pollution by 30% and traffic volume by 10%. The car ban in Italy is the latest of such moves by urban authorities to reduce vehicle pollution and congestion. As Töpfer said, it is an important precedent that "gives the city back to its citizens."

For more information, contact: Italian Ministry of Environment, Via Cristoforo Colombo 44, 00147 Rome, Italy, Tel: +39 (6) 57221; or Sharad Shankardass, Habitat Media and Press Relations, Tel: +254 (2) 623153, Fax: +254 (2) 624060, E-mail: habitat.press@unchs.org. ◆

Industry Updates

Mexico rates corporate environmental performance

PROFEPA, Mexico's environmental protection agency, has released a report rating thousands of Mexican companies on three environmental performance indicators. The agency collected data on over 6000 companies' air emissions and generation of solid and hazardous wastes in the past five years. On a scale of 1 to 100, companies had an average score of just 51.4 for air pollution, 52 for hazardous waste and 60 for solid and infectious waste generation.

The petroleum industry had the lowest scores. Pemex, Mexico's giant oil monopoly, scored only 11.2 points for its emissions. The pharmaceutical industry received the best overall scores, followed by the paper industry, automobile manufacturers and the textile industry.

While PROFEPA characterized the average scores as mediocre, they noted that corporations which have already voluntarily joined the national environmental auditing programme were not included in the survey. Many of these companies would score high on PROFEPA's scale, meeting or exceeding Mexico's pollution and hazardous waste emissions standards, because of their participation in the programme. PROFEPA also pointed out that most of the companies surveyed would have little difficulty improving their environmental performance, as many of the low scores were due to reporting and administrative infractions rather than procedural problems.

For further information, contact: PROFEPA, Periférico Sur No. 5000, 5to piso, Col. Insurgentes Cuicuilco, Deleg. Coyoacan, México, DF, C.P. 04530, Mexico. Tel: +52 5 5 28 54 09 or +52 5 5 28 54 17. Fax: +52 5 5 28 54 32. E-mail: pfpweb@correo.profepa.gob.mx. Internet: www.profepa.gob.mx. ◆

More US companies must report toxics data

Seven major US industrial sectors have been added to the list of those required to release toxic waste data to the public. The Environmental Protection Agency (EPA) will require the coal and metal mining sectors, electric utilities, chemical wholesalers, hazardous waste treatment and disposal facilities, petroleum bulk plants and terminals, and solvent recovery services to report the quantities of toxic chemicals they release annually to air, water and soil.

The EPA compiles these data in the Toxics Release Inventory (TRI), which is made available to the public as part of the US Community Right-to-Know programme. This programme originated as a response to the deadly release of methyl isocyanate that killed thousands of people in Bhopal, India, in 1984. Its main purpose is to make communities and citizens aware of chemical hazards in their area.

The TRI inventory collects information on waste management activities and the release of toxic chemicals by facilities manufacturing, processing or otherwise using over 644 chemicals. It applies to manufacturing facilities with 10 or more full-time employees that meet the established thresholds for annual manufacturing, processing or other use of listed chemicals: manufacturing or processing of over 25,000 pounds (11,300 kg), or use of over 10,000 pounds (4500 kg), of designated chemicals or chemical categories.

The first TRI report based on these expanded requirements, using data from 1998, showed that the greatest quantities of the listed chemicals were emitted by metal mining and electric utilities, at 1.57 billion and 500 million kg of toxic emissions respectively.

The EPA points out that toxic emissions fell by 45% during the first decade in which TRI was required. For example, toxic releases from manufacturing between 1997 and 1998 fell by 90 million pounds (40.5 million kg) and air emissions by 6%. Combined emissions from all sectors reporting totalled 7.3 billion pounds (3.28 billion kg), a figure that will be used as the baseline for future reporting. The EPA hopes that releasing the data publicly will encourage industries to continue reducing overall emissions.

As part of the TRI programme, the EPA publishes industry-specific and chemical-specific guidance documents and conducts an ongoing dialogue among stakeholders. Extensive information concerning the programme is available on the TRI web site (*www.epa.gov/tri/*).

For more information, also contact: Luke C. Hester, US EPA. Tel: +1 (202) 564 7818. ◆

UK report: poor environmental reporting by IT companies

According to a report released in March, information technology (IT) companies in the United Kingdom have a "dismal" environmental reporting record. A study conducted by the independent Pensions Investment Research Consultants (PIRC) looked at corporate environmental reporting in 38 industrial sectors. Only 14% of companies said they had an environmental policy. None of the IT companies described any improvements in assessing impacts, target-setting or carrying out green audits during the previous year.

PIRC's Research Director, Stuart Bell, says that "all companies, whatever their sector, have environmental impacts such as energy use and production of waste. These findings bring into question the commitment of 'new economy' companies to good environmental management."

Results of the survey, which covered 674 companies listed in the All-Share Index, also demonstrate that environmental reporting is significantly worse among smaller companies. Half of FTSE 100 companies report on environmental improvements and target-setting, but fewer than 10% of SmallCap companies do so. The UK government encourages all companies with over 250 employees to carry out environmental reporting. Overall, however, publication of separate environmental reports shows little progress. Such publications are largely produced by FTSE 100 companies.

Good reporting appears to be associated with either strict regulation, very high environmental impacts or a large consumer base, according to PIRC. The sectors that had done best at reporting were utilities, especially electricity companies; industries such as mining, oil and gas, steel, paper, chemicals and construction; and some service sectors such as food retailing and telecommunications. Many of the manufacturing sectors characterized by significant environmental impacts and lack of a public consumer base, such as engineering, automobile components and electronics, as well as conglomerates, had done less well.

For more information, contact: PIRC, 4th Floor, Cityside, 40 Adler Street, London E1 1EE, UK. Tel: +44 (207) 247 2323. Fax: +44 (207) 247 2457. E-mail: JaniceH@pirc.co.uk. Internet: www.pirc.co.uk. ◆

Germany to reduce noise near airports

The German government has announced plans to reduce the noise level experienced by those living near airports, following presentation of new scientific evidence showing that excessive noise can cause health problems. The German Environment Minister, Jürgen Trittin, said at a news conference in February that his ministry had drafted a bill that makes airport operators pay for installation of new noise reduction infrastructure at airports. The move is a response to the German Council of Environmental Advisors' 1999 *Special Report on Environment and Health*, which states that aircraft noise levels above 65 decibels (dB) increase the risk of heart attacks and other circulation-related problems.

The report, which finds that over 50% of the German population is affected by aircraft and airport noise, recommends that daytime noise levels not exceed 55 dB. The Council points out that measurable noise-related sleep disturbances may

begin at average indoor levels of 35-45 dB, and that maximum levels should be no higher than 45-55 dB. It recommends a night level of 55 dB as a near-term goal. In the longer term, there are already WHO recommended average levels of 30 dB and maximum levels of 45 dB.

Because of the high relevance of sleeping disturbances to health, the Council said, it is not sufficient to set an average night noise level; maximum levels should also be established. It pointed out that physiological reactions which could be dangerous to health in the long term could be detected even at levels seen, until recently, as merely annoying. The Council also said further study is needed to determine whether present maximum levels are in fact adequate to protect human health.

Trittin said the new law would require day noise levels for residents near airports to be reduced to 65-60 dB from the present 75-67 dB. Night noise levels for residents would be lowered to 50 dB from the present 60 dB. Trittin noted that a major consequence of the law would be that older, louder aircraft, especially the type transporting cargo, would no longer be able to land at German airports. He did not address the issue of the new measure's cost to airport operators. However, operators at Düsseldorf, Frankfurt and Munich responded that the infrastructure at their airports already ensures safe noise levels, and that their facilities are among the quietest in Europe.

The European Parliament has also addressed this issue. A resolution on night flights and excessive noise, passed in April, calls for a coordinated European Community framework to regulate airport noise. The resolution recommends use of fee incentives, landing slot allocations, congestion relief measures and restrictions on night flights to alleviate aircraft-related noise pollution.

Trittin plans to introduce the bill during Germany's current legislative period, which ends in 2002. The Social Democrat- Green government has a majority in the Bundestag, or lower house, where the bill is expected to pass easily. However, it also must be approved by the Bundesrat, or upper house, where there is not a government majority.

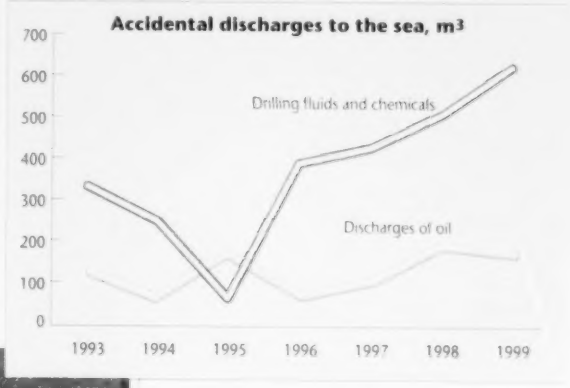
Information in German, including the text of the *Special Report on Environment and Health*, is available on the German Environment Ministry's web site (*www.bmu.de*). Information in German and English concerning airport noise is available on the web site of Germany's Federal Organization Against Airport and Aircraft Noise, or Bundesvereinigung gegen Fluglärm e.V. (BVF) (*www.fluglaerm.de/bvf* and *www.airportnoise.de*). ◆

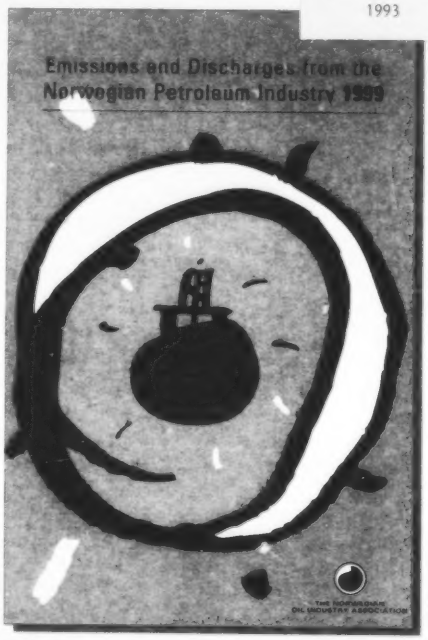
Norwegian oil industry publishes emissions information

Oil and gas production is Norway's largest single industrial sector, contributing about 10% of GDP in 1998. It is also an important source of pollution. For example, production activities accounted for 22% of CO_2 emissions that year.

While cleaner production technologies and better environmental management techniques have reduced many of the industry's pollution emissions per unit of oil produced, the overall quantity of emissions will remain significant, as oil production is expected to increase during the first few years of the 21st century. The Norwegian Oil Industry Association (OLF) has produced a report on the industry's air emissions and discharges to the sea in 1999. It includes emissions and discharges from both exploration and production phases. The report details the quantity and composition of discharges from drilling and well maintenance, and methods used to dispose of them, as well as discharges of oily water, heavy metals and organic compounds resulting from well operations.

While both consumption and discharges of chemicals have increased, much of the increase is due to greater use of gas treatment chemicals that are in fact less harmful to the marine environment. Air emissions result mainly from use of combustion equipment such as turbines, engines and boilers, as well as from gas flaring and crude oil loading. Gas flaring has more than doubled since 1992, while diesel fuel consumption has increased by 120% since 1990.





Information on accidental discharges of oil, chemicals and drilling fluids to the sea and air is also included. While there were fewer incidents of releases of drilling fluids and chemicals than of oil releases (110 compared to 250), chemical discharges were on average eight times greater, resulting in a significantly greater total volume of discharges (see figure).

The report is also available in English and Norwegian at *www.olf.no*. This site presents additional data and referenced information.

For more information, contact: OLF, PO Box 547, N-4003 Stavanger, Norway. Tel: +47 (51) 84 65 00, Fax: +47 (51) 84 65 01, E-mail: firmapost@olf.no.

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UNEP Focus

The Malmö Declaration on Environmental Action

Environment ministers met in May at Malmö, Sweden, for the first *Global Ministerial Environment Forum*. They identified the 21st century's major environmental challenges and discussed the roles of the private sector and civil society in addressing them, with the goal of regaining policy coherence in the environmental field. The Forum concluded with adoption of the *Malmö Declaration*, an action-oriented agreement intended to help establish the environmental agenda for the 21st century.

Sponsored by UNEP and hosted by the Government of Sweden, the Forum also served as the Sixth Special Session of the UNEP Governing Council. It offered an opportunity to bridge information and policy gaps on critical environmental issues through informal discussions among over 70 environment ministers and global leaders from academia, business and industry, and civil groups such as NGOs and the media.

The Malmö Declaration will provide major input to the UN's *Millennium General Assembly* in September 2000 and to the *Rio +10 summit* in 2002, which together will establish the global environment and sustainable development agenda for years to come. The Declaration states that the 2002 summit should aim to address the greatest challenges to sustainable development, particularly the "pervasive effects of the burden of poverty on a large proportion of the Earth's inhabitants", seen against "excessive and wasteful consumption and inefficient resource use" by others. It recognizes "the central importance of environmental compliance, enforcement and liability" and integrates the concept of a life cycle approach with regard to the responsibility of the private sector into the text.

The Declaration calls for integration of environmental considerations in the mainstream of decision-making, and for emphasizing preventive action. It states that the environmental perspective should be taken into account in the design and assessment of macroeconomic policy-making, as well as in the practices of government and multilateral lending and credit institutions such as export credit agencies.

There is an alarming discrepancy between commitments and action. Goals and targets agreed by the international community in relation to sustainable development, such as the adoption of national sustainable development strategies and increased support to developing countries, must be implemented in a timely fashion. The mobilization of domestic and international resources, including development assistance, far beyond current levels is vital to the success of this endeavour.

Malmö Declaration

The Declaration emphasizes UNEP's major role, especially with regard to its engagement and collaboration with both the private sector and civil organizations. It recommends that the role of UNEP in international environmental governance be strengthened, and that its financial base be broadened and made more predictable.

The Forum is an example of a fundamental and important shift within the UN towards the use of partnerships to promote peace and prosperity. The UN recognizes that governments, intergovernmental and non-governmental organizations, the business community and private citizens are all necessary to meet new and existing environmental challenges.

A major challenge remains concerning ways to move from analysis to action on global environmental problems. The Malmö Declaration refers to the growing number of international environmental agreements. Participants pointed out that in many cases these agreements are not being implemented, often due to national or local-level obstacles such as lack of commitment and inability or unwillingness to allocate resources to implementation. The Declaration stresses the importance of taking action and calls for "a new spirit of cooperation and urgency."

Strong support was given to UNEP's ongoing and overall activities. The UNEP water policy and strategy, which emphasizes assessment, management and coordination of actions, was endorsed. The Forum also stressed the importance of UNEP's role in preparing for Rio +10.

The next Global Ministerial Environment Forum will be held at Nairobi in February 2001, on the occasion of the 21st session of the UNEP Governing Council.

The Malmö Declaration is available in English, French and Spanish on the UNEP web site (*www.unep.org/malmo/*).

For more information, contact: Robert Bisset, UNEP Press Officer, Tel: +254 (2) 623084, Fax: +254 (2) 623692, E-mail: robert.bisset@unep.org. ◆

World Environment Day message: time is running out

In 1972, the UN General Assembly designated 5 June as World Environment Day to bring attention to environmental problems and the need for action by governments, individuals, businesses, NGOs and community groups. With the theme "2000 – The Environment Millennium – Time to Act", this year's World Environment Day was marked by calls for genuine and effective efforts to reverse environmental damage and to work towards sustainable development. UNEP's Executive Director, Klaus Töpfer, stressed the need for global cooperation as well as local action for sustainable development.

"In our daily lives, it is not always easy to recognize how closely we are interconnected with our fellow human beings. Increasingly, however, we are recognizing that what connects the street child in Rio, the farmer in Kalimantan, the factory worker

Jacqueline Aloisi de Larderel, Director of UNEP DTIE, at the Global Ministerial Environment Forum in Malmö. With her are Chung Dong-soo, Vice Minister, Korean Ministry of Environment (right) and Timothy W. Foresman, the new Director of UNEP's Division of Environmental Information, Assessment and Early Warning.

Message from the UN Secretary General on the Occasion of World Environment Day

Our quest for a healthy environment is a never-ending process. It should be an integral part of our way of life. The theme for this year's World Environment Day, "2000 – The Environment Millennium – Time to Act", is a timely reminder of our role in the ecosystem.

In the last millennium, and particularly in the last century, realizing this role has proved to be a great challenge. Never in the history of mankind have we done so much, in so little time, to destroy the wonderful ecosystem that sustains us. The repercussions of our destructive action will be felt for generations to come. Indeed, it may take another millennium to put things right.

We celebrate World Environment Day in the knowledge that environmental issues are inextricably linked to those of peaceful coexistence, international cooperation and economic development.

Despite the great strides made in recognizing that development must coexist with the environment, we continue to search for economic progress in ways that erode the ecological foundations of our existence. Our very survival as a species may depend on our ability to reconcile technological progress with moral progress.

On this World Environment Day, and in this United Nations International Year for the Culture of Peace, let us resolve to take positive steps to fight the degradation of our environment. Let us combine our technological and creative skills with true wisdom, and reverse the trend of violence against nature and our fellow beings.

Otherwise, we may not have another thousand years to correct our mistakes.

Kofi A. Annan
Secretary General of the United Nations
5 June 2000

in Germany and the stockbroker in New York is the global environment," he said. "More and more, we are realizing how interdependent we are, and that what we do has far-reaching ramifications – even if the connections are not immediately obvious. In fact, the ramifications are already being felt in every corner of the globe." Töpfer called for a 21st century environmental agenda to drive environmental improvements accompanying economic and social gains: "Global agreements that ensure trade and environment policies are mutually supportive must succeed in helping the poorest of the poor in the world. They must also succeed for the sake of the environment."

The main venue for World Environment Day events this year was Adelaide, Australia. Events included a meeting on the environment with business leaders, establishment of a Millennium Tree Park in South Australia, the Australian Youth Parliament on the Environment, tree planting in Sydney and Melbourne, and an environmental parade whose theme was water. The world's largest volunteer organization, Trees for Life, planted some 1.5 million trees around the State of South Australia.

Australian events also included presentation of UNEP's Global 500 award to 14 individuals and organizations from 13 countries that have made outstanding contributions to the protection of the environment. This year's winners include an aboriginal community in Australia, two journalists from Spain and the United States, and a wildlife orphanage in South Africa.

During World Environment Day preparations, Töpfer said: "We are at a watershed. We have the knowledge and the technology to solve many of the environmental ills facing our planet. What we need now is more political will to bring about change. Now is the time to act."

Additional information on World Environment Day and the UNEP Global 500 awards is available in the Media Room on UNEP's web site (*www.unep.org*).

For more information, contact: Tore J. Brevik, UNEP Spokesman, Tel: +254 (2) 623292, Fax: +254 (2) 623692, E-mail: tore.brevik@unep.org. ◆

UNEP strengthens cooperation with the Russian Federation

Acknowledging Russia's importance with regard to global environmental problems, as well as the country's need to address local and national environmental threats, UNEP is increasing its cooperation with the Russian Federation. It will open a Moscow office to work more closely with the Russian government on global issues such as climate change and ozone depletion. The new office will also collaborate with environmental authorities and civil society on programmes to improve environmental conditions within the Federation.

According to Victor Danilov-Danilyan, chairman of the Russian State Environment Committee, almost half of Russia's people live in environmentally dangerous conditions. Over 14% of the land area is in poor environmental condition, and air pollution in 120 Russian cities is five times higher than acceptable levels due to industrial pollution.

UNEP cooperates with Russia on a range of environmental programmes, including the Cleaner Production Programme and the Chemicals Programme. The new Moscow office will work closely with the office of UNEP's Global Resources Information Database (GRID) already established in Moscow in order to make use of its capacity-building activities.

For more information, contact: Anders Renlund, UNEP Regional Office for Europe, 15 chemin des Anémones, CH-1219 Châtelaine, Geneva, Switzerland. Tel: +41 (22) 917 8272, Fax: +41 (22) 917 8024, E-mail: anders.renlund@unep.ch. ◆

Initiative promotes a common global environmental vocabulary

UNEP is collaborating with international government and research agencies on a new initiative to develop a global multilingual environmental thesaurus. This joint project of Italy's Consiglio Nazionale delle Richerche (CNR), the European Environment Agency (EEA), the US EPA and UNEP represents an effort to lower the linguistic barriers to international exchange of environmental information. The partners met in Santa Fe, New Mexico (USA) in January to launch the initiative.

A common environmental vocabulary is intended to aid development of environmental information systems and retrieval of environmental information from the Internet and other electronic resources. The thesaurus is expected to be useful to database developers, librarians and translators, and to provide environmental decision-makers and the public with greater access to global information systems.

The new thesaurus will bring together the resources of CNR (a multilingual thesaurus developer) with those of the EEA's GEMET and UNEP's EnVoc thesauruses, as well as the EPA's existing activities in environmental terminology and its ongoing work with the Asia-Pacific Economic Cooperation. The four participants expect other partners to join the consortium and to contribute to the thesaurus' development. Thus European and non-European language groups will eventually have access to a standard environmental vocabulary in multiple languages.

For more information, contact: Gerard Cunningham, INFOTERRA, the Global Environmental Information Exchange Network, UNEP Division of Environmental Information, Assessment and Early Warning, PO Box 30552, Nairobi, Kenya. Tel: +254 (2) 623275, Fax: +254 (2) 624269, E-mail: cunningg@unep.org. ◆

UNEP launches interactive web sites

In the first six months of 2000, UNEP and its partner organizations inaugurated five new online forums that allow users to obtain information on, and contribute to the discussion of, major environmental issues and initiatives.

The GEF forum's web site (*gef-forum.unep.org*) provides a platform for dialogue among scientists on issues of global environmental importance. Its goal is to mobilize the wider scientific and technical community in Global Environment Facility (GEF) programmes. As an initial step towards achieving this goal, the interactive forum facilitates threaded, focused and moderated discussions using the Internet or E-mail. To keep discussions focused, dialogue is based on an "issue agenda". Dialogue conclusions will formulate recommen-

dations for GEF policy. There are two discussion forums on the web site:

- The Interactive Forum on GEF Land and Water Initiative in Africa is part of the UN System-wide Initiative for Africa. It aims to address land and water-related environmental challenges facing African countries in an integrated manner, and will create a framework for coordination of bilateral and multilateral donors.
- The Interactive Forum on Agrobiodiversity allows experts and scientists to exchange views on the conservation and sustainable use of agricultural biodiversity, including sharing of its benefits, identification of areas of research and development. This in turn will be used as input to the GEF-OP or national programme.

Additional forums are planned soon on sustainable use of biodiversity and on power sector reform.

UNEP DTIE's OzonAction Programme forums (*www.uneptie.org/ozat/forum/index.html*) are E-mail networking and information services whose purpose is to assist countries in phasing out ozone depleting substances (ODS) by the deadlines defined under the Montreal Protocol. By subscribing to an issue-specific service, participants can choose to take part in discussions or to receive issue-specific updates that are distributed periodically via E-mail. There are two forum areas:

- The Climate and Ozone Discussion Forum and CHO₃ Update Service facilitates the exchange of viewpoints on issues relevant to the simultaneous implementation of the Kyoto Protocol on Climate Change and the Montreal Protocol.
- The Methyl Bromide Alternatives Discussion Forum and RUMBA Update Service facilitates exchange of viewpoints on issues related to elimination of the ozone-depleting fumigant methyl bromide.

In cooperation with the International Ocean Institute, UNEP has launched the GPA News Forum (*gpanews.unep.org*), which is designed to stimulate discussion of topics of interest regarding the Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities. The News Forum is part of the GPA clearing-house, a referral system to mobilize experience and expertise and facilitate scientific, technical and financial cooperation. As part of the GPA clearing-house, the News Forum provides information on recent GPA-related activities at the national, regional and global levels, including capacity-building opportunities, progress in key or pilot projects, and upcoming meetings workshops and conferences.

Articles featured on the News Forum recently have addressed hazardous tanning in Tamil Nadu, India, protection of the Black Sea environment, and regional cooperation and local action to fight land-based marine pollution in the Caribbean.

For more information on GEF forums, contact: Sean Khan, UNEP, INFOTERRA/GEF, PO Box 30552, Nairobi, Kenya. Tel: +254 (2) 623271, Fax: +254 (2) 624041, E-mail: sean.khan@unep.org. For information on OzonAction forums, contact: Rajendra Shende, UNEP DTIE Ozon-Action and Energy Programme, 39-43 quai André Citroën, 75739 Paris Cedex 15, France. Tel: +33 (1) 44 37 14 59, E-mail:rajendra.shende@unep.fr. For information on the GPA News forum, contact: International Ocean Institute-Canada, Dalhousie University, 1226 LeMarchant Street, Halifax NS B3H 3P7, Canada. Tel: +1 (902) 494 1737, Fax: +1 (902) 494 2034, E-mail: ioihfx@dal.ca. ◆

New IETC Director

Steve Halls has been appointed Director of UNEP's International Environmental Technology Centre (IETC) in the Division of Technology, Industry and Economics (DTIE). He assumed the post on 1 February. Halls, an engineer and biologist by training, has more than 20 years of experience in environmental consulting, science and education. He founded the Institute for Sustainable Development at the University of Luton (UK) in 1995 and served as its Director until 1997. He has been involved in developing the European Eco-Management and Audit Scheme and was a member of the European Commission Steering Committee Group on the Development of Waste Management Policy and Strategy for Europe in 1997 and 1998. Halls now serves as the Secretary General of the European Society for Environment and Development, a pan-European organization that promotes sustainable development, environmental standards and professional development.

IETC was established in 1993 to assist developing countries and those in transition to use environmentally sound technologies to manage urban and freshwater basin environmental problems. Located in Japan (Osaka and Shiga), its current focuses include water supply, sewage, solid waste, urban sprawl, land contamination, air pollution and noise management.

Steve Halls

For more information, contact: Françoise Ruffé, UNEP DTIE, 39-43 quai André Citroën, 75739 Paris Cedex 15, France. Tel: +33 (1) 44 37 14 50, Fax: +33 (1) 44 37 14 74, E-mail: unep.tie@unep.fr; or UNEP IETC, Osaka Office: 2-110 Ryokuchi Koen, Tsurumi-ku, Osaka 538-0036, Japan. Tel: +81 (6) 6915 4580, Fax: +81 (6) 6915 0304; Shiga Office: 1091 Oroshimo-cho, Kusatsu City, Shiga 525-0001, Japan. Tel: +81 (77) 568 4586, Fax: +81 (77) 568 4587, E-mail: ietc@unep.or.jp, Internet: www.unep.or.jp. ◆

Books & Reports

GENERAL

Environment and Trade: A Handbook

Links between trade and multilateral environment agreements were high on the agenda of the Commission on Sustainable Development (CSD) this year, especially in the aftermath of the Seattle World Trade Organization Conference. This Handbook, produced by UNEP's Economics and Trade Unit (UNEP ETU) in co-operation with the International Institute for Sustainable Development (IISD), contributes to the ongoing discussions. International trade flows are at US$ 6 trillion per year, and the rules that govern them can be a major force for economic, environmental and social change. The Handbook's purpose is to make relationships between trade and environment more understandable and accessible to policy-makers, NGOs and the general public. While it is addressed mainly to those with some knowledge of the subject, the authors have used non-specialist language to make it more accessible to all elements of civil society.

The Handbook aims to dispel the idea that relationships between trade, environment and sustainable development can be easily described as either negative or positive. Immensely complex interactions vary from one country, economic activity or firm to another. Both threats and opportunities exist for countries, local communities and firms that are pursuing economic development and environmental protection goals.

Chapter topics include an overview of international environmental management, including the development of multilateral environmental agreements; the basics of the WTO; physical and economic links between trade and sustainable development; interactions between trade law and environmental law, both nationally and internationally; institutional issues and transparency in processes; and environmental aspects of existing regional trade agreements.

The Handbook is also available in a continually updated Internet version at both *www.unep.ch/etu* and *www.iisd.ca/trade/handbook*.

(2000). UNEP ETU and IISD. Available from the UNEP Online Bookshop (www.earthprint.com) or from SMI (Distribution Services) Ltd, PO Box 119, Stevenage, Hertfordshire SG1 4TP, UK. Fax: +44 (1438) 748 844, E-mail: Anthony@smibooks.com. Pbk., 84p. ISBN 1-89553-62109.

Phasing Lead Out of Gasoline: An Examination of Policy Approaches in Different Countries

Since the 1970s, when the health effects of exposure to airborne lead were first suspected, a consensus has grown among governments, the lead and automobile industries, and health experts that gasoline should not contain lead. Subsequent studies have confirmed that lead absorption by the body has detrimental effects, particularly on early development of the nervous system in children and fetuses. In view of the potential health effects, many governments have established programmes for complete elimination of lead use as a gasoline additive. By 1999, unleaded gasoline accounted for 80% of total worldwide sales and lead content had been reduced in a significant portion of the remaining 20%. The results of these efforts have shown that lead can be removed from gasoline without harm and with net economic benefits. However, millions of people in Asia, Latin America, and particularly Africa are still exposed to unacceptable levels of airborne lead.

This joint UNEP/OECD publication is intended to help policy-makers select the best options and programmes for reducing and eventually eliminating lead use in gasoline. It provides guidance on the various policy options available, including fuel distribution and vehicle manufacturers' approaches. The importance of correct tax or pricing policies is highlighted. Examples from different countries provide "real world" experience.

(2000). UNEP and OECD. Available from the UNEP Online Bookshop (www.earthprint.com) or SMI (see above). Pbk., 14p. ISBN 92-807-1796-0.

Economic Instruments for Environmental Management

This UNEP publication presents empirical evidence of economic instruments' power with regard to environmental management. Using case studies from Africa, Asia, Europe and Latin America, it describes a wide variety of environmental problems to which economic instruments have been applied successfully, from grazing land policy to water treatment on industrial estates. Prepared by UNEP's Economics and Trade Unit, *Economic Instruments for Environmental Management* is intended to provide policy-makers and economists with examples drawn mainly from developing countries while allowing researchers from these countries to present their views. The effectiveness of economic instruments versus regulations is discussed, as well as the special problems of applying such instruments in developing countries and countries in transition.

(2000). UNEP Publications, 11-13, chemin des Anémones, CH-1219 Châtelaine, Geneva, Switzerland. Tel: +41 (22) 979 91 11, Fax: +41 (22) 797 34 60, E-mail: irptc@unep.ch. Also available from the UNEP Online Bookshop (www.earthprint.com). Pbk., 208p. ISBN 1-85383-690-7.

State of the World 2000

The Worldwatch Institute's 17th annual report examines environmental, social, economic and political trends that "have put the global economy on a collision course with the Earth's ecosystems." The authors call for rapid transition to an environmentally sustainable economy, in order to avoid permanent damage to the natural systems that support global civilization. Pointing out that over a billion people lack clean water, that species loss is accelerating and that there is growing evidence of climate change, they recommend ways to use political systems to manage the complex relationships between the global economy and the Earth's ecosystems.

(2000). Worldwatch Institute, 1776 Massachusetts Ave., NW, Washington, DC 20036-1904, USA. Tel: +1 (202) 452-1999, Fax: +1 (202) 296-7365, E-mail: wwpub@worldwatch.org, Internet: www.worldwatch.org. Pbk., 262p. ISBN 0-393-31998-9.

Vital Signs 2000

Vital Signs (subtitled "Environmental trends that are shaping our future") is a companion volume to *State of the World 2000* (above). It defines 50 trends affecting the global environment and points to progress towards sustainability in the areas of food production, agricultural resources, energy, the atmosphere, the economy, transportation, communication, society and the military. While many indicators are alarming (growth in national debt and in the number of those afflicted with HIV/AIDS in poor countries, falling harvests of grain, fish and soybeans, and continuing deterioration of groundwater quality worldwide), some positive developments are cited. Increased use of wind- and solar-generated energy, and of environmental taxes to discourage pollution, are examples of trends that could help reverse environmental deterioration.

(2000). Worldwatch Institute (see above). Pbk., 192p. ISBN 0-393-32022-7.

Vanishing Borders: Protecting the Planet in the Age of Globalization

From climate change to trade in threatened species, environmental problems are increasingly transnational in nature. The author of this Worldwatch publication believes that "vanishing borders" also provide opportunities for making environmental gains. She proposes integrating ecological considerations into international trade

rules through changes in treaties and institutions. The ways new communications technologies can make it possible for NGOs and concerned citizens worldwide to pressure governments and corporations to take environmental issues into account are described.

Hilary French (2000). Worldwatch Institute (see above). Pbk., 257p. ISBN 0-393-32004-9.

The International Factor 10 Club's Reports of 1999

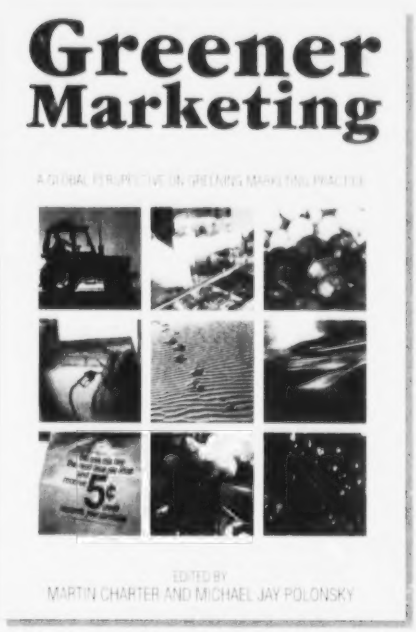
The International Factor 10 Club, founded in 1994, is an international body of senior government, NGO, industry and academic leaders created to draw attention to, and counteract, the global trend towards increasing and unsustainable resource consumption. Its members agree that in the next 30 to 50 years industrialized countries need to work towards reducing present global nonrenewable material flows by half, including minerals, freshwater and nonrenewable energy carriers. The Club's name and activities are based on the principle that within one generation countries could achieve a 10-fold increase in the efficiency with which they use energy and natural resources, and that such a goal is now technologically possible and requires only appropriate policy and institutional changes.

This report explains how the development of less resource-intensive products and services – "dematerialization" – can be accomplished in day-to-day business practices. Case studies and examples from Austrian and German companies are presented. The report explains how resource productivity is measured using Material Inputs Per unit Service (MIPS). It also demonstrates how to calculate "ecological rucksacks" containing all of the resource and energy consumption involved in the production of end-products. By applying the MIPS and rucksack concepts, the authors maintain that companies and consumers can compare inputs and end-use products based on resources required for production and use. However, they also point out that reducing products' resource intensity is not enough to achieve sustainable consumption. Changing consumers' habits and preferences is also necessary.

F. Schmidt-Bleek, Y. Paleocrassis, F. Lehner, W. Bierter and T. Charles (1999). Institute for Work and Technology, Science Centre North Rhine-Westphalia, Munscheidstrasse 14, D-45886 Gelsenkirchen, Germany. Tel: +49 (209) 1707 0, Fax: +49 (209) 1707 110, E-mail: lehner@iatge.de, Internet: iat-info.iatge.de. Pbk., 151p. ISSN 0949-4944.

Greener Marketing: A Global Perspective on Greening Marketing Practice

The editors of *Greener Marketing* believe that social issues, including the environment, are increasingly becoming critical issues for corporations trying to meet customer expectations, and that marketing practices must take such issues into account if companies are to succeed in the long



term. Not only must companies produce more environmentally friendly products and services, but they must ultimately change their own and customers' expectations and behaviour if their businesses are to be made sustainable. This will require integrating environmental issues into every aspect of a business, beginning even before product design by asking whether the product is necessary and can be produced sustainably. Equally important will be how companies get their message across to consumers, and how they can demonstrate that their products or services (and their total operations) address customers' concerns more effectively than those of their competitors. Articles address strategic issues and the rationale for green marketing, as well as tactical issues such as the focus on services rather than products. Nine case studies from different types of businesses in several parts of the world are presented.

Martin Charter and Michael Jay Polonsky, eds. (1999). Greenleaf Publishing, Aizlewood Business Centre, Aizlewood's Mill, Nursery Street, Sheffield S3 8GG, UK. Tel: +44 (114) 282 3475, Fax: +44 (114) 282 3476, E-mail: greenleaf@worldscope.co.uk, Internet: www.greenleaf-publishing.com. Hbk., 432p. ISBN 1-874719-14-4.

Ecological Economics: An Introduction

The interdisciplinary field of ecological economics draws on the natural sciences, economics, philosophy and other disciplines to achieve a more complete understanding of human-ecosystem interactions. Current research in this field includes the study of nature conservation, land use planning, pollution control, natural resource management and environmental impact assessment. *Ecological Economics* provides an introduction, emphasizing the complementary roles of economics, ecology and ethics in environmental policy. The principles at the core of different approaches to environmental problems, and the tools and techniques used in these approaches, are explained. Examples of their application are also given.

C. Edward-Jones, B. Davies and S. Hussein (2000). Blackwell Science Ltd., Osney Mead, Oxford OX2 0EL, UK. Tel: +44 (1865) 206 206, Fax: +44 (1865) 721 205, Internet: www.blackwell-science.com, Pbk., 266p. ISBN 0-8654-2796-8.

Handbook of Environmental Management and Technology

This Handbook is aimed primarily at engineers, industrial hygienists, health and safety officers, and plant engineers and managers. It covers a wide range of aspects of environmental management and control, as well as background issues and regulatory approaches, mainly from a US viewpoint. Sections are devoted to air and water pollution, solid and hazardous waste, radioactive materials, pollution prevention and energy conservation, remediation technologies and risk assessments. The authors also discuss ISO 14000 and US federal and state regulations pertaining to environmental management.

G. Burke, B.R. Singh and L. Theodore (2000). John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158-0012, USA. Tel: +1 (212) 850 6011, Fax: +1 (212) 850 6008, E-mail: info@wiley.com, Internet: www.wiley.com, Hbk., 806p. ISBN 0-471-34910-0.

The Reality of Sustainable Trade

The social and environmental conditions of production are becoming part of Northern buyers' standard commercial considerations with regard to many of the South's industrial sectors, such as agriculture, forestry and garment manufacturing. A growing number of producers in the South are combining high social standards with successful exporting, but according to this new book from the International Institute for Environment and Development (IIED) there has been only intermittent progress towards sustainable trade. The IIED surveyed several developing countries, including Bangladesh (shrimp, garments, leather), Ghana (cocoa and pineapple), India (textiles) and South Africa (tourism). Increasing demand-side pressures on producers in developing countries are having some effect on producer practices. However, they can also be potentially harmful if producers alone are expected to bear the full costs of transition.

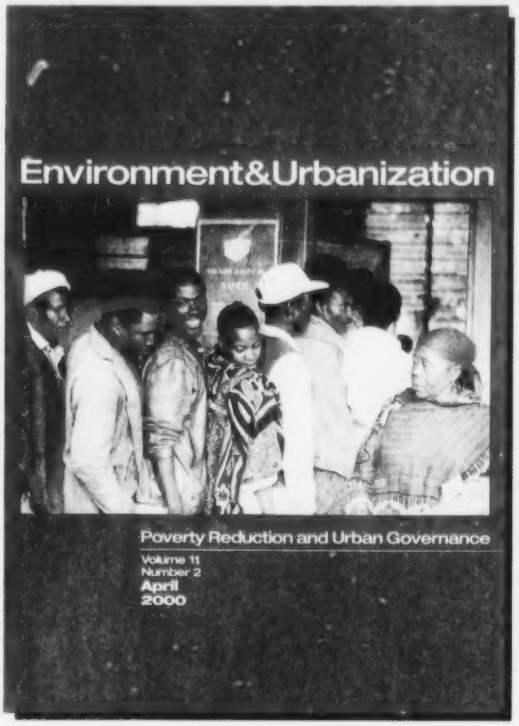
The Reality of Sustainable Trade is part of IIED's Stimulating Sustainable Trade series, which examines the impacts of social and environmental requirements on North-South trade and ways to encourage trade in more sustainable goods and services.

Nick Robins and Sarah Roberts, eds. (2000). IIED, 3 Endsleigh Street, London WC1H 0DD, UK. Tel: +44 (207) 388 2117, Fax: +44 (207) 388 2826, E-mail: bookshop@iied.org, Internet: www.iied.org, Pbk., 120p. ISSN 1562-3319.

"Poverty Reduction and Urban Governance," Environment and Urbanization, Vol. 12, No. 1 (April 2000)

Urban poverty is greatly influenced by local governments – not only by what they do or don't do, but also by what they can or can't do, according to the International Institute for Environment and Development (IIED). Nevertheless, local governments receive relatively little attention in discussions of poverty and poverty reduction, which tend to focus on the roles of national governments and international aid agencies. This issue of *Environment and Urbanization* examines local government's current and potential role in urban poverty reduction. The introductory article by IIED's staff provides background information on urban poverty and the factors that contribute to it. It discusses the prospects for local government action to reduce poverty, arguing that local governments often fail to meet their obligations to large sections of their populations in regard to housing, infrastructure, services and political inclusion. Deficiencies in these areas aggravate and perpetuate urban poverty. They also contribute to the enormous and growing problems of urban environmental degradation. However, the authors acknowledge the limits of local governments' ability to combat poverty through directly increasing incomes.

Articles from contributors cover cities in the developing world, including Guatemala City (Guatemala), Cebu (Philippines), Bamako (Mali) and Ahmedabad (India). Some of the articles discuss ways local government actions and policies can help alleviate the multiple deprivations suffered by the urban poor; others present examples of ways to improve the effectiveness of aid from international donors. The complexity of the political and economic factors in cities that influence who gets land, infrastructure and services is emphasized. The articles stress that political systems in which the urban poor have little influence are unlikely to provide effective poverty relief.



Environment and Urbanization, a twice-yearly journal published by IIED, examines environmental issues related to urban areas and urbanization in Africa, Asia and Latin America. Recent issues have focused on sustainable cities and urban health; back issues focusing on other themes are available. A sister publication, *Medio Ambiente y Urbanizacion*, contains Spanish-language articles and concentrates on Latin America.

(2000). IIED, 3 Endsleigh Street, London WC1H 0DD, UK. Tel: +44 (171) 388 2117, Fax: +44 (171) 388 2826, E-mail: humans@iied.org, Internet: www.iied.org/human/env_urb.html. Pbk., 256p.

Sustainable Technology Development

The Dutch government commissioned a five-year research programme to determine what technologies and development paths are needed in order to achieve a sustainable world, using a method called "backcasting." The project began with a vision of a sustainable future in 50 years that met all the known environmental and economic constraints, and in which factor 10 to factor 20 eco-efficiency had been achieved. The backcasting method set out to describe steps that should be taken now, so that the necessary technologies and systems would be in place. This "virtual hindsight" led to 15 case study projects on nutrition, shelter, mobility, materials and water. *Sustainable Technology Development* presents several of the case studies. Prospects for sustainable technologies are evaluated.

P. Weaver, L. Jansen, G. van Grootveld, E. van Spiegel and P. Vergragt (2000). Greenleaf Publishing (see above). Hbk., 304p. ISBN 1-874719-09-8.

Small and Medium-Sized Enterprises and the Environment

Small and medium-sized enterprises (SMEs), defined as those employing fewer that 250 people, provide the majority of jobs globally and contribute significantly to GDP. They are also one of the fastest growing parts of the economy in most countries. While relatively small individually, collectively they are not only an important component of national economies but are also responsible for a large share of pollution and waste. There have been a number of attempts, especially in industrialized countries, to engage SMEs in environmental management activities, but most have met with limited success at best.

Small and Medium-Sized Enterprises and the Environment looks at why getting SMEs involved in environmental protection has been so difficult. It describes appropriate programmes and tools for environmental management, along with practical strategies for reaching SMEs and introducing the concept of environmental stewardship. It also presents case studies from several countries, including developing ones, where environmental management activities have been initiated successfully in smaller companies.

Ruth Hillary, ed. (2000). Greenleaf Publishing (see above). Hbk., 391p. ISBN 1-874719-22-5.

Natural Disasters: Protecting the Public's Health

Natural disasters often cause severe health effects, both directly and indirectly, that can continue long afterward. The health sector is therefore an essential part of disaster planning and preparedness. This Pan American Health Organization (PAHO) publication outlines the role of health professionals in planning for, and responding to, disasters in order to reduce their impacts. It describes disasters' health effects and summarizes the organizational steps needed to respond effectively, emphasizing the importance of a multisectoral approach. Topics covered include preparation of disaster plans, inter-agency coordination, training, and supply management.

Environmental health management is also covered, including information on water and food supplies, sanitation, waste management and disease vector control. The book is intended primarily for health professionals. However, recognizing that disaster management is increasingly an intersectoral effort, the authors have also aimed it at others involved in disaster preparedness and response.

The full text is available on line, in PDF format, at *www.paho.org/English/PED/sp575.htm.*

(2000). PAHO, World Health Organization, 525 23rd Street, NW, Washington, DC 20037, USA. Tel: +1 (202) 974 3525, Fax: +1 (202) 775 4578, E-mail: disaster@paho.org, Internet: www.paho.org, Pbk., 119p. ISBN 92-75-11575-3.

ENERGY

Power Sector Reform in Subsaharan Africa

Power sectors in Susaharan Africa face many problems, including the frequent unreliability of power supplies, inefficient operation of entities within a sector, and limited access to electricity by most of the population. Power sector reform, including privatization and restructuring, has the potential to contribute to development and to increase access to electric power for large numbers of Africans. Case studies from six countries (Côte d'Ivoire, Ghana, Kenya, Mauritius, Uganda and Zimbabwe) assess the electric utility industry's performance and efficiency, present rationales for reform, and discuss the choice of reform paths and how reforms have been initiated. The authors, who include engineers, policy advisors, economists and utility directors, also address the policy implications of reform, rural electrification issues and demand-side management.

John K. Turkson, ed. (2000). St. Martin's Press, Inc., Scholarly and Reference Division, 175 Fifth Avenue, New York, NY 10010, USA. Tel: +1 (212) 982 3900. Fax: +1 (212) 777 6359. E-mail: smarketing@stmartins.com. Internet: www.stmartins.com. Hbk. 222p. ISBN 0-333-75129-9.

Energy for Tomorrow's World – Acting Now!

In this report on energy developments in the last decade, the World Energy Council (WEC), an energy industry association, surveys global energy trends and makes policy recommendations for sustainable energy growth and use. The most significant energy indicator since the last survey in 1993 remains the unequal distribution of energy use worldwide, with only 20% of the world's population (in the developed countries) consuming some 60% of the global energy supply. Approximately 1.6 billion people live without electricity or any other commercial energy supply. Pointing out that a significant proportion of harmful pollution in developing countries comes from indoor use of coal or wood and other biomass fuels, the WEC advocates cleaner technologies, more use of renewable energy sources, and greater access to electricity and gas for the world's poor.

(2000). WEC, 5th Floor, Regency House, 1-4 Warwick Street, London EC1R 0NE, UK. Tel: +44 (20) 7734 5996, Fax: +44 (20) 7734 5926, E-mail: info@worldenergy.org, Internet: www.worldenergy.org. Pbk., 146p. ISBN 1-90164-00-06-X.

Keys for Sustainable Development: Energy, Biodiversity and Space

This brochure published by the Dutch Ministry of Housing, Spatial Planning and the Environment looks at the interrelationship of energy, resource use and land.

(1999). Ministry of Housing, Spatial Planning and the Environment, PO Box 20951, 2500 EZ The Hague, The Netherlands. Tel: +31 (70) 339 4820, Fax: +31 (70) 339 1291, Internet: www.minvrom.nl. Pbk., 19p.

CLIMATE CHANGE AIR POLLUTION

Japan and Germany: Towards co-ordinated climate protection strategies

The success of efforts to control global warming will depend on the concerted activities of governments and private industry. While individual governments need to establish the framework within which companies choose emissions reduction options, there is great potential for international cooperation among both governments and industries.

Japan's Institute for Global Environmental Strategies and Germany's Wuppertal Institute for Climate, Environment and Energy have initiated a policy dialogue between the two countries to facilitate coordination of domestic emissions reduction measures at the company and national levels, as well as to establish best practices in both countries and promote competition among progressive companies. This publication includes the results of an initial workshop held in Tokyo in March 2000, the results of a survey of German and Japanese businesses, and three background papers on economic instruments, greener products and production, and sustainable and eco-efficient enterprises.

Hermann E. Ott and Tsuneo Takeuchi, eds. (2000). Wuppertal Institute, Döppersberg 9, 42103 Wuppertal, Germany. Tel: +49 (202) 24920, Fax: +49 (202) 2492 108, E-mail: info@wupperinst.org, Internet: www.wupperinst.org. Pbk., 95p. ISBN 3-929944-26-X.

Air Pollution Engineering Manual

This is the second edition of the *Air Pollution Engineering Manual*. It has been updated to reflect the most recent emission factors and control measures for industries in the US or operating under US regulatory requirements. The Manual includes background material on pollution control engineering, choice of equipment, economics, and regulatory requirements. There are chapters on controlling gaseous pollutants, particulates and dust, as well as discussions of combustion sources such as coal and fuel oil and waste incineration sources such as municipal waste burning and sewage sludge. There are separate, detailed sections on pollution control technologies used in 11 major industry groups and a section on accidental and catastrophic releases of air pollutants. The Manual is intended for industry and government professionals directly involved in the choice of air pollution control technologies and in their operation, as well as for students and educators in the field of environmental engineering.

Wayne T. Davis, ed. (2000). John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158-0012, USA. Tel: +1 (212) 850 6011, Fax: +1 (212) 850 6008, E-mail: info@wiley.com, Internet: www.wiley.com. Hbk., 886p. ISBN 0-471-33333-6.

INDUSTRY SECTORS

Food Processing Sector Guides for Cleaner Production Assessment

UNEP DTIE and the Danish Environmental Protection Agency have jointly developed a series of Industry Sector Guides on Cleaner Production Assessment. Three sector-specific guides have recently been published:

Cleaner Production Assessment in Dairy Processing *(2000). Pbk. ISBN 92-807-1842-8.*

Cleaner Production Assessment in Fish Processing *(2000). Pbk. ISBN 92-807-1843-6.*

Cleaner Production Assessment in Meat Processing *(2000). Pbk. ISBN 92-807-1844-4.*

Each guide in this series contains background information concerning the industry and environmental issues, including quantitative data on rates of resource consumption and waste generation. There is detailed information on the principles of cleaner production and cleaner production assessment procedures. Opportunities to improve environmental performance in specific sectors through applying cleaner production are discussed. Case studies of successful cleaner production projects are also presented. References and information sources are provided in annexes.

These guides are intended to be used by cleaner production professionals and managers of industries, in order to conduct cleaner production assessments in relevant industry sectors. They can also be used as reference materials by governments or consultants in developing cleaner production projects and relevant policies.

Electronic copies may be downloaded from *www.agrifood-forum.net/publications/guidelindex.htm.*

(2000). UNEP. Available from: SMI (Distribution Services) Ltd, PO Box 119, Stevenage, Hertfordshire SG1 4TP, UK. Fax: +44 (1438) 748 844, E-mail: Anthony@unibooks.com.

Sustainable Development and the Future of Mineral Investment

This UNEP publication begins by offering a perspective on the normative and philosophical aspects of sustainable development, before proceeding to a discussion of sustainability as applied to the mineral industry. It includes a review of the roles and interests of various stakeholders in mining projects, such as mining companies, the public and government regulators. Methods and indicators for assessing sustainability in the industry are examined. *Sustainable Development and its*

Future of Mineral Investment is written for a wide audience and should be understandable by readers who are not experts in the field.

James M. Otto and John Cordes, eds. (2000). UNEP DTIE, 39-43 quai André Citroen, 75739 Paris Cedex 15, France. Tel: +33 (1) 44 37 14 50, Fax: +33 (1) 44 37 14 74, E-mail: unep.tie@unep.fr, Internet: www.uneptie.org. Pbk., 208p. ISBN 92-807-1913-0.

CHEMICALS, POLLUTION AND ACCIDENTS

Chemistry, Society and Environment: A New History of the British Chemical Industry

Believing that the present environmental crisis can only be understood in light of its history, the authors of *Chemistry, Society and Environment* have analyzed the chemical industry's impact on society in the U.K. as a whole. They describe the industry's development in the context of its environmental effects, showing that although the word "environment" was scarcely used before the 1960s, environmental impacts have been a source of concern since the industry began. Chemical companies' records, museum and news archives, government documents and earlier industrial histories, as well as industrial archaeology sites, were examined in an effort to provide a balanced view.

The book is divided into sections describing the industry's general organization and the history, processes, and environmental and social effects of individual branches, including alkali, nitrogen, pharmaceutical, organic and inorganic, metal-related and petroleum-based chemical manufacturing. It concludes with an assessment of the relationship between the chemical industry and the country's quality of life, as well as the industry's role in climate change, ozone depletion and other global issues.

Colin A. Russell, ed. (2000). Royal Society of Chemistry Turpin Distribution Services, Ltd, Blackhorse Road, Letchworth, Hertfordshire SG6 1HN, UK. Tel: +44 (1462) 672 555, Fax: +44 (1462) 480 947, E-mail: turpin@rsc.org, Internet: www.rsc.org. Hbk., 372p. ISBN 0-85404-599-6.

Principles of Toxicology

An understanding of the principles of toxicology is essential in determining the risks chemical pollutants pose to human health and the environment. This textbook covers the theory and practical application of toxicological studies in both industrial settings and the ambient environment. It introduces the basic concepts of toxicology (e.g. dose-response relationships) and includes chapters on the physiological processes by which toxic substances affect health, the effects of toxicants on various major body systems and functions, and the properties and effects of various types of toxic chemicals. The authors emphasize the applied aspects of toxicology, covering risk assessment, occupational and environmental health, and epidemiology.

Principles of Toxicology is intended for industrial hygienists, occupational physicians, safety engineers, and others involved in environmental health and safety.

P.L. Williams, R.C. James and S.M. Roberts, eds. (2000). John Wiley & Sons, Inc. (see above). Hbk., 603p. ISBN 0-471-29321-0.

Environmental Toxicants: Human Exposures and their Health Effects

Toxic substances have become widespread in the environment (though usually at low concentrations) as a result of human activities. The effects of workplace exposure to toxic substances have been studied extensively, but less information is available on the effects of low-level exposure to toxicants in the natural environment on large populations. This book therefore focuses on non-occupational exposure to environmental toxicants. It summarizes the characteristics of chemical contaminants, including their physical properties, techniques for measuring environmental concentrations, and the routes of human exposure – through air, water, food or direct contact.

Environmental Toxicants addresses the problems associated with estimating exposure rates and the relationship between exposure and adverse health effects. It surveys a broad range of toxic substances and the risks associated with exposure to them. Separate chapters treat common toxicants, including aerosol particles, asbestos, carbon monoxide, diesel exhaust, drinking water disinfectants, food additives, lead, microwaves, ozone and other topics. The authors also treat broader issues such as individual and community risk, environmental engineering for risk reduction, and knowledge gained in the industrial sector. *Environmental Toxicants* is intended for public health officials, industrial hygienists, epidemiologists and physicians involved in assessing and managing risks to exposed populations.

Morton Lippmann, ed. (2000). John Wiley & Sons, Inc. (see above). Hbk., 987p. ISBN 0-471-29298-2.

Phytoremediation of Toxic Metals

Contamination of soil and water with toxic metals is a major environmental problem, especially at active and former industrial and military sites. Metals, which can have serious effects on human health and on ecosystems, are difficult and expensive to remediate using current methods that rely mainly on excavation and burial at hazardous waste sites. Many sites remain contaminated since, at an average cost of over US$ 2 million per hectare, they are too costly to clean up.

This collection of technical papers explores various aspects of phytoremediation: the use of plants to remove contaminants from the soil. Some contributors discuss the economic and regulatory issues involved and prospects for public acceptance of new technologies. Others present studies of various phytoremediation processes, including the use of plants that absorb metals from the soil into the plant mass, which can then be harvested and recycled to reclaim the metal or dispose of it properly. *Phytoremediation of Toxic Metals* also includes information on the biological and molecular processes involved in phytoremediation.

I. Raskin and B.D. Ensley, eds. (2000). John Wiley & Sons, Inc. (see above). Hbk., 304p. ISBN 0-471-19254-6.

IPCS Environmental Health Criteria

The International Programme on Chemical Safety (IPCS) is a joint venture between UNEP, the International Labour Organisation (ILO) and the World Health Organization (WHO). The IPCS Environmental Health Criteria series provides critical reviews of potential health and environmental effects of chemicals and combinations of chemicals. These are primarily risk evaluations and are based on published and unpublished studies. The series is published in English, with summaries in French and Spanish. It is available from WHO and its sales agents. Six new titles are available:

EHC 211: Health Effects of Interactions between Tobacco Use and Exposure to Other Agents *(1999). Pbk, 149p. ISBN 92-4-157211-6.*

EHC 212: Principles and Methods for Assessing Allergic Hypersensitization Associated with Exposure to Chemicals *(1999). Pbk, 399p. ISBN 92-4-157212-4.*

EHC 213: Carbon Monoxide, 2nd ed. *(1999). Pbk, 464p. ISBN 92-4-157213-2.*

EHC 215: Vinyl Chloride *(1999). Pbk, 356p. ISBN 92-4-157215-9.*

EHC 217: Bacillus thuringiensis *(1999). Pbk, 105p. ISBN 92-4-157217-5.*

EHC 218: Flame Retardants: Tris(2-butoxyethyl) Phosphate, Tris(2-ethylhexyl) Phosphate and Tetrakis(hydroxymethyl) Phosphonium Salts *(2000). Pbk, 130p. ISBN 92-4-157218-3.*

WHO, Distribution and Sales, Geneva 27, Switzerland. Tel: +41 (22) 791 2476, Fax: +41 (22) 791 4857, E-mail: bookorders@who.ch, Internet: www.who.int.

Road Map to Understanding Innovative Technology Options for Brownfields Investigation and Cleanup, Second Edition

The US Environmental Protection Agency produced this guide to brownfields remediation information with the goal of speeding up rehabilitation of such sites while reducing associated costs. Brownfields, defined as abandoned, idle or underused industrial and commercial sites whose redevelopment is complicated by real or perceived environmental contamination, are common in many older cities and industrial areas.

This book provides extensive references to, and summaries of, publications and web sites with information on brownfield clean-up technologies. It focuses on relatively new technologies that have been shown to be successful in pilot programmes

for remediation of a number of types of soil and water contamination. It is meant to serve as a "road map" guiding the user through the steps involved in choosing options.

A CD-ROM containing the text of many of the referenced publications is included. This publication is intended for planning and public health officials, developers, private citizens, and other stakeholders who have decision-making responsibility but who may be unfamiliar with the issues involved in cleaning up brownfield sites. Although the regulatory issues discussed apply mainly to the US, the technologies and strategies described in the listed publications and resources can be used in other countries as well.

(2000). US EPA, National Service Center for Environmental Publications, PO Box 42419, Cincinnati, OH 45242, USA. Tel: +1 (513) 489 8190, Fax: +1 (513) 489 8695, Internet: www.epa.gov/ncepihom. Pbk., 94p.

Innovative Remediation and Site Characterization Technologies Resources

This CD-ROM contains a variety of information resources that can assist brownfield site managers in evaluating and choosing among site clean-up alternatives. It includes citizens' guides explaining the most commonly used innovative technologies, as well as summaries of fact sheets, journals, online resources and other information sources. In

some cases these sources are also included in PDF format. There are extensive lists of references and of organizations that provide information about site characterization and remediation technologies. The CD also presents 140 case studies with cost and performance information on remediation technologies.

(2000). US EPA (see above). CD-ROM.

The Chemistry of Pollution

The health and environmental threats posed by pollution are a function not only of the original characteristics of the polluting substances, but also of the changes these substances undergo in the natural environment. Smog is a notable example. The chemical components of automobile emissions are converted in the atmosphere by solar energy into ozone and other compounds, many of them toxic. Chemical conversions can also transform toxic substances into less harmful compounds.

The Chemistry of Pollution surveys the chemical aspects of pollutants in air, water and soil. It covers common toxics such as carbon monoxide (CO), sulphur dioxide (SO_2) and heavy metals. It also discusses chemical processes that affect the toxicity of compounds in food and consumer goods and includes a brief section on radioactivity. This book is intended for chemistry students and others interested in the chemical principles of environmental pollution.

Günter Tellenberg (2000). John Wiley & Sons, Inc. (see above). Pbk., 192p. ISBN 0-471-61391-6.

Continuous Emission Monitoring

Continuous emission monitoring (CEM) systems permit sampling, analysis and measurement of air emissions, throughout the operations of an emissions source, without the need for manual sampling and laboratory analysis. CEM systems are increasingly being incorporated into the regulatory programmes of air pollution control agencies worldwide. They are used not only to check the performance of air pollution control devices, but also to assess compliance with regulations and to establish emissions allowances in the US acid rain control programme.

Continuous Emission Monitoring examines both the technical issues and regulatory considerations involved in choosing and operating CEM systems, taking into consideration the varied requirements imposed by different processes, equipment types and emissions standards. Its purpose is to enable the user to assess the operating characteristics of commercial systems and evaluate them for a specific application. It is intended for environmental engineers in industry and in control agencies, CEM users, and inspectors and auditors.

James A. Jahnke (2000). John Wiley & Sons, Inc. (see above). Hbk., 404p. ISBN 0-471-29227-3.

Nuclear Test Explosions

The Scientific Committee on Problems of the Environment (SCOPE), part of the International Council for Science, investigated the environmental and human impacts of all nuclear tests carried out between 1945 and 1998. In this publication it gives the location and dates of 730 explosions and 2419 tests at sites including those in the US, Russia, China and the South Pacific. The Committee assesses the fallout from atmospheric tests and describes the development of nuclear weapons and the testing programmes of countries that possess nuclear weapons. The bulk of *Nuclear Test Explosions* is devoted to an examination of environmental contamination, health effects, and estimations of radiation doses from each of the known test explosions.

Sir Frederick Warner and René J.C. Kinchmann, eds. (2000). SCOPE. Available from John Wiley & Sons, Inc. (see above). Hbk., 275p. ISBN 0-471-97848-5.

Reducing the Use of Hazardous Substances in Personal Computers

This report, based on three Master's theses produced at Lund University, looks at how different incentives and barriers can influence companies to consider environmental aspects in developing and using electronic products, especially personal computers. The first part examines drivers of, and barriers to, reduced chemical use in the computer industry. It concludes that the industry is often constrained by short-term financial considerations that limit the ability to integrate sustainability and hazard reduction concepts into product design.

The second part focuses on the influence of eco-labelling schemes on product development and their effectiveness as an environmental policy tool. It concludes that some labelling schemes have the potential to influence product development, but that their effectiveness is limited by lack of customer awareness and concern about the environmental aspects of PCs.

The third part analyzes the implications of World Trade Organization rules on product policy and mandatory information instruments. It concludes that such instruments represent the greatest potential for trade law conflicts because of their restrictive effects on trade. While WTO trade rules allow national mandatory instruments to address downstream impacts of hazardous substances, they do not allow different treatment of products based on their upstream processing and production methods. The report also contains a summary of EU and Swedish chemicals legislation.

(2000). Swedish National Chemicals Inspectorate, PO Box 1384, S-171 27 Solna, Sweden. Tel: +46 (8) 783 1100, Fax: +46 (8) 735 7698, E-mail: kemi@kemi.se, Internet: www.kemi.se. Pbk., 130p. ISSN 0284-1185.

NATIONAL/REGIONAL

Environmental Impact of Refugees in Guinea

Several hundred thousand refugees have arrived in Guinea in recent years, mainly because of the conflicts in nearby Sierra Leone and Liberia. In July 1999, the Government of Guinea and the Secretary General of the UN asked UNEP to investigate the environmental impacts of the refugee situation. This report documents the findings of UNEP's investigation, which involved visits to a number of refugee camps and urban centres. The investigators found serious short-term and long-term impacts in both rural and urban areas, including a rapid increase in waste generation and severe strains on water supplies and sanitation systems. In rural areas, the addition of refugees' needs to those of the local population has exacerbated problems of deforestation and land degradation.

The report includes recommendations for improving response to environmental pressures

created by the presence of refugees. It is also available on the Internet at *www.grid.unep.ch/guinea.*

UNEP Regional Office for Africa, PO Box 30552, Nairobi, Kenya. Tel: +254 (2) 62 4283/4284, Fax: +254 (2) 62 3928, E-mail: rpainfo@unep.org. Pbk., 21p.

Asian Approach to Resource Conservation and Environment Protection

The Asian Productivity Organization (APO) conducts annual training on resource conservation and environmental protection for its members, a group of Asian and Pacific country governments. This volume collects the proceedings and papers presented at the 1998 conference. It includes an overview of the approach to resource conservation and environmental protection in the region, and individual country papers provide more detail and statistics on the environment for each APO member.

(2000). APO, Hirakawa-cho Dai-ichi Seimei Building 2F, 1-2-10, Hirakawa-cho, Chiyoda-ku, Tokyo 102-0093, Japan. Tel: +81 (3) 5226 3920, Fax: +81 (3) 5226 3950, E-mail: apo@gol.com, Internet: www.apo-tokyo.com. Pbk., 284p. ISBN 92-833-2246-0

Green Korea 2000

Green Korea 2000 presents the Korean government's environmental policies and plans for the years 1998–2002, as well as a summary of projects carried out between 1992 and 1996. The goal of these plans, as stated by the Ministry of Environment, is "to build a society that is environmentally friendly, one that respects ecological values, and that is environmentally sound and sustainable." This report summarizes efforts in the areas of nature conservation, air and water quality management, waste management, public education and involvement, and the development of environmental industries and technologies. It includes data on the water quality of major river systems, capacity and level of service of sewage systems, and participation in recycling schemes.

The report includes case studies of Korean industries that have joined the Environmentally Friendly Enterprise System, a government-sponsored voluntary initiative for companies to set and meet environmental targets.

Green Korea 2000 also discusses Korea's participation in international environmental treaties and conventions and in cooperative agreements with its neighbours, as well as Local Agenda 21 activities. Tables present the organization and responsibilities of the Ministry of Environment and the major environmental laws in effect in Korea.

(2000). Korean Ministry of Environment, Government Complex Kwacheon, Kwacheon 427-760, Korea. Tel: +822 (504) 9244, Fax: +822 (504) 9206, Internet: www.me.go.kr. Pbk., 77p.

Field	Act
Environmental Management	Environmental Policy Act Environmental Dispute Settlement Act Special Act Relating to the Control of Environmental Crimes Act Relating to Support and Development of Environmental Technologies Environmental Improvement Act, etc. Act Act Relating to Environmental Improvement Charges Environmental Management Corporation Act Korean Resources Recovery and Reutilization Corporation Act Natural Environment Conservation Act
Natural Environment Management	Natural Parks Act Act for Environmental, Traffic and Disasters Impact Assessments Special Act Relating to the Conservation of Island Ecosystems such as Tokdo, etc. Soil Environment Preservation Act Wetlands Preservation Act
Air and Noise Management	Air Quality Preservation Act Noise and Vibration Control Act Air Quality Management Act for Underground Living Spaces Public Display Prevention Act
Water Management	Act Relating to Treatment of Sewage, Night Soil and Livestock Wastewater Drinking Water Management Act Act of Water Body Water Quality Management Act Water Supply and Waterworks Installation Act Sewage Treatment Act Act Relating to Water Resource Quality Improvement and Local Resident Support in the Han River Watershed
Waste Management	Waste Management Act Act Relating to Promotion of Resource Saving and Recirculation Act Relating to the Transboundary Movement of Waste and its Disposal Act for Promotion of Waste Treatment Facilities and Local Communities Toxic Chemicals Control Act Act Relating to Establishment and Operation of the Metropolitan Area Landfill Management Corporation

The State of India's Environment: The Citizens' Fifth Report

The Centre for Science and the Environment (CSE) in New Delhi first published a survey of the state of India's environment in 1985. This report updates and expands that survey, covering environmental issues, events, policies and practices. Due to India's vast size and geographical and ecological diversity, it has tremendous natural resources. However, it also has severe and worsening environmental problems, ranging from deforestation to water shortages to urban industrial blight. The authors argue that India's government has been unable to deal with these issues, acting only when a problem becomes a crisis. They suggest that political as well as technological solutions will be necessary to reverse environmental damage.

The report comes in two volumes. The first is divided into sections describing the condition of land, water, forests, natural habitat, air, natural resources and energy, as well as human health and political factors. The second is a statistical database of India's environment.

(1999). CSE, 41, Tughlakabad Institutional Area, New Delhi 110 062, India. Tel: +91 (11) 6981110, Fax: +91 (11) 6985879, E-mail: ceo@cseindia.org, Internet: www.cseindia.org. Hbk., 2 volumes, 440p. and 256p.

Environmental Governance

To meet the challenges of the coming century in India, the UN Development Programme (UNDP) initiated the Capacity 21 Project in 1995. Its goal is to build understanding and capacity for environmental economics in research institutions, government agencies, NGOs and the private sector, and to promote concern for sustainability among decision- and policy-makers in government and industry. The project focuses on the four main areas of air quality, water quality, land resources and biodiversity. As part of the project, the Indira Ghandi Institute of Development Research (IGIDR) has prepared four strategy briefs for these four areas.

Clean Water (Environmental Governance 1) describes the extent and causes of water pollution in India and its health and other consequences. The economic, technical and legal approaches needed to cope with the problem are outlined. *Pbk., 24p.*

Wetlands (Environmental Governance 2) addresses issues related to the sustainable management and conservation of wetlands, which are among India's most productive and most endangered biological systems. It describes the various problems of, and threats to, wetlands and the legal protections available to preserve them. *Pbk., 24p.*

Land and Forest Regeneration (Environmental Governance 3) examines the causes and consequences of land degradation and deforestation and suggests strategies for reversing the damage. *Pbk., 28p.*

Clean Air (Environmental Governance 4) discusses the problems of air pollution in India, which like many countries suffers from serious indoor air quality problems and adverse health effects due to common use of biofuels for cooking and heating. *Pbk., 24p.*

(2000). IDIGR, Gen. Vaidya Marg, Goregaon (E), Mumbai 400 065, India. Tel: +91 (22) 8400919, Fax: +91 (22) 8402752 or 8402026, E-mail: cap21@igidr.ac.in, Internet: www.igidr.ac.in.

Old Sins: Industrial Metabolism, Heavy Metal Pollution, and Environmental Transition in Central Europe

Industrial metabolism studies look at the total consequences of resource consumption by society, using analysis of energy and material flows and their environmental consequences. Such flows have increased enormously in both quantity and geographic extent since the Industrial Revolution. As material flows have increased and become more complex, they have also become more "open", increasing losses to the environment in the form of waste. This book, based on two projects in the Rhine Basin and the Black Triangle-Upper Silesia region, presents examples of the industrial metabolism approach to understanding regional environmental change. The authors include historical studies of heavy metals use and pollution in Europe to illustrate how spatial patterns of emissions and depositions of such metals in the environment have changed over time. Presenting the development of the Rhine Basin as an example of the shift in pollution trends in OECD countries over the past few decades, they discuss the problems involved in simultaneous economic restructuring and environmental remediation, combining technical analyses with studies of social, political and economic developments related to the environment.

S. Anderberg, S. Prieler, K. Olendrzynski and S. de Bruyn, eds. (2000). The United Nations University Press, 53-70, Jingumae 5-chome, Shibuya-ku, Tokyo, 150-8925, Japan. Tel: +81 (3) 3499 2811, Fax: +81 (3) 3406 7345, E-mail: sales@hq.unu.edu, Internet: www.unu.edu. Pbk., 194p. ISBN 92-808-1049-9.

Sourcebook on Environmental Funds in Economies in Transition

This regional overview surveys 21 environmental funds in the Central and Eastern European Countries and the New Independent States of the former Soviet Union. Many countries use such funds to help meet environmental financing challenges during economic transition. They are usually governmental or quasi-governmental institutions that obtain revenue from sources such as environmental fees or fines and provide grants or loans for environmental protection activities. In many CEEC/NIS such funds have contributed to accelerated environmental remediation and capacity building.

The main features of the funds, their effectiveness as environmental policy tools, and their record of managing public monies are assessed. Recommendations are made for improving institutional capacity and management, as well as the design and implementation of economic instruments and methods of setting priorities and selecting projects.

(2000). OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France. Tel: +33 (1) 45 24 82 00, Fax: +33 (1) 49 10 42 76, Internet: www.oecd.org/bookshop, Pbk., 267p.

Web Site Highlights

UNDP Human Development Report on the Web

www.undp.org/hdro

The full text of the UNDP's annual Human Development report is now available online. It includes statistics on income, life expectancy, education, access to essential services, and many other measures of human welfare and development.

International Office for Water

www.oieau.fr/anglais/index.htm

The International Office for Water (IOW) is a non-profit organization located in Paris. Its objective is to establish a network of public and private partners worldwide engaged in water resources management and protection. The site also exists in French, Spanish and Portuguese.

Pachamama

www.unep.org/geo2000/pacha/

"Pachamama: Our Earth, Our Future," the youth edition of UNEP's GEO 2000 report, has its own web site. The Pachamama site contains information, case studies, artwork and poetry by young people. It has been compiled so as to present a worldwide assessment of environmental issues ranging from atmospheric and freshwater problems to urbanization and the protection of polar regions. Also included is the ECOMIND Maze Game, an interactive component of the report, which tests the user's knowledge of present and emerging global issues presented in GEO 2000.

For more information, contact: Tessa Converse, UNEP, E-mail: tessa.converse@unep.org, or Tore J. Brevik, UNEP Spokesman, Tel: +254 (2) 623292, Fax: +254 (2) 623927.

Environmental Performance Reviews: Greece and Hungary

The OECD's Environmental Performance Review series compiles environmental and economic data on OECD and other countries. Each report includes information on the country's geography and resources, a survey of its social, economic and institutional development, and an analysis of its environmental policy. Current environmental conditions and air, water and waste management activities are assessed. An EPR analyzes the country's integration of environmental and economic decisions and its record in meeting both domestic objectives and international commitments. Recommendations are made for overall policy implementation and for improving environmental protection in selected industry sectors. Two new EPRs have been published:

Greece, *Pbk., 204p. ISBN 92-64-17189-4*

Hungary, *Pbk., 198p. ISBN 92-64-17195-9*

(2000). OECD Publications (see above). A first series of Environmental Performance Reviews have been carried out for Australia, Austria, Belarus, Belgium, Bulgaria, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Russian Federation, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. A second series will begin to appear soon.

Sustainable Development in Canada

This series of monographs was prepared as part of Canada's participation in recent sessions of the UN Commission on Sustainable Development (CSD). Environment Canada published six new titles as a contribution to the land use dialogue at the Eighth Session of CSD in April. They describe experience with issues concerning sustainable development of land resources and the challenges that remain with regard to integration of sustainable development.

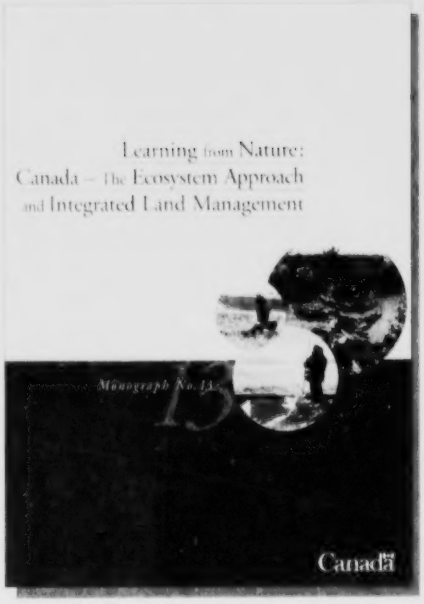
Cultivating a Secure Future: Rural Development and Sustainable Agriculture in Canada (Monograph No. 8). This monograph describes government approaches to rural development in Canada, emphasizing that sustainable rural development depends not so much on sustainable agriculture as on economic diversification. It discusses steps that have already been taken towards sustainable agriculture, and concludes with a list of the next steps that can move Canada further along in stabilizing and building rural communities and ensuring that agriculture can be practised profitably and in an environmentally sound way in the future. *Pbk., 68p. ISBN 0-662-64842-7*

Sustainable Forest Management: A Commitment in Canada (Monograph No. 9). In 1998, Canada adopted a five-year strategy to bring together the ecological, economic, social and cultural aspects of forest conservation and use. This title describes the strategy and reflects international, national, provincial and local initiatives as well as the criteria and indicators used to measure and report on progress in sustainable forest management. The monograph also profiles the role forests play in meeting the needs of Aboriginal people in Canada and the special perspectives they bring to sustainable forest management through their enduring relationship with the land. *Pbk., 80p. ISBN 0-662-64839-3*

Minerals and Metals: Towards a Sustainable Future (Monograph No. 10). This report highlights some of the major economic, environmental and social issues facing the minerals and metals sector. It reviews recent Canadian government and industry initiatives and the various international organizations that work in the area of sustainable development of minerals and metals. This monograph updates the earlier one on minerals and metals, prepared for the 1997 review of Agenda 21, to reflect experience and the evolution in thinking since the release of the *Minerals and Metals Policy of the Government of Canada: Partnerships for Sustainable Development* in 1996. *Pbk., 40p. ISBN 0-662-64828-5.*

Indigenous Peoples and Sustainable Development in the Canadian Arctic (Monograph No. 11). This report identifies the progress made on Chapter 26 of Agenda 21, "Recognizing and Strengthening the Role of Indigenous People and Their Communities". It traces the Government of Canada's efforts to implement and build on commitments in pursuit of sustainable development with Indigenous communities in the Canadian Arctic. *Pbk., 44p. 0-662-64830-3.*

The Contribution of Earth Sciences to Sustainable Land and Resource Management (Monograph No. 12). Earth sciences are crucial for balanced decision-making regarding sustainable land and resource management. This monograph discusses earth sciences in Canada and describes how they contribute to the sustainable and integrated management of land and resources by generating, analyzing and disseminating information for land use decision-making on local, regional and global scales. *Pbk., 40p. ISBN 0-662-64832-3.*



Learning from Nature: Canada – The Ecosystem Approach and Integrated Land Management (Monograph No. 13). An ecosystem approach is fundamental to managing marine and terrestrial ecosystems and their adjoining coastal areas. This monograph explains the concept of the ecosystem approach to resource management and how it is being applied in Canada. Because the focus of Chapter 10 of Agenda 21 is managing land sustainably, integrated land use planning and management is featured and the report covers terrestrial ecosystems in more depth than marine areas. The report also focuses on the connections between people and the environment, including the short- and long-term implications of human activities and the processes, components, functions and carrying capacity of ecosystems. *Pbk., 68p. ISBN 0-662-64831-5.*

Each title includes the complete text in both English and French. The full texts, along with previous titles in the series, are also available on Environment Canada's web site (*www.ec.gc.ca*).

(2000). Environment Canada, Enquiry Centre, Ottawa, ON K1A 0H3, Canada. Tel: +1 (819) 997-2800, Fax: +1 (819) 953-2225, E-mail: enviroinfo@ec.gc.ca.

THE UNEP DIVISION OF TECHNOLOGY, INDUSTRY AND ECONOMICS

Current uses and development of natural resources, technologies and production processes, as well as urbanization patterns, have negative effects on human health and the environment. This is illustrated by unsustainable use of water, land and energy, air and water pollution, persistent and toxic bio-accumulative chemicals in the food chain, and other industry-related problems. To have a healthy environment, we need to change how we produce and consume goods and services. This change involves revising and developing economic policies and trade practices so as to integrate environmental issues in the planning and assessment processes.

UNEP's Division of Technology, Industry and Economics (UNEP DTIE) was created in 1998 to help decision-makers in governments, local authorities and industry develop and adopt policies and practices that:

- are cleaner and safer;
- use natural resources efficiently;
- ensure adequate management of chemicals;
- incorporate environmental costs;
- reduce pollution and risks for humans and the environment.

UNEP DTIE, whose main office is in Paris, is composed of:

◆ **The International Environmental Technology Centre (Osaka)**, which promotes the adoption and use of environmentally sound technologies, with a focus on the environmental management of cities and freshwater basins, in developing countries and countries in transition.

◆ **The Production and Consumption Unit (Paris)**, which fosters the development of cleaner and safer production and consumption patterns that lead to increased efficiency in the use of natural resources and reductions in pollution.

◆ **The Chemicals Unit (Geneva)**, which promotes sustainable development by catalyzing global actions and building national capacities for the sound management of chemicals and the improvement of chemical safety world-wide, with a priority on Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC, jointly with FAO).

◆ **The Energy and OzonAction Unit (Paris)**, which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition, and promotes good management practices and use of energy, with a focus on atmospheric impacts. The UNEP/RISØ Collaborating Centre on Energy and Environment supports the work of this Unit.

◆ **The Economics and Trade Unit (Geneva)**, which promotes the use and application of assessment and incentive tools for environmental policy, and helps improve the understanding of linkages between trade and environment and the role of financial institutions in promoting sustainable development.

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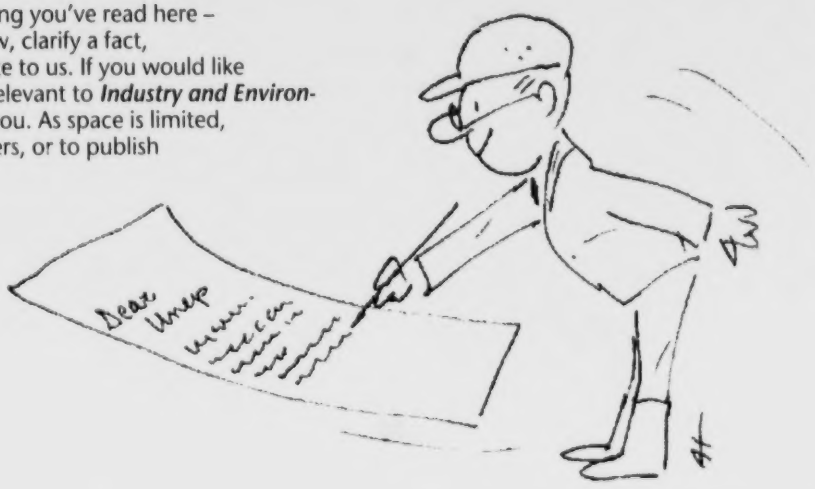

Industry and Environment

a publication of the United Nations Environment Programme
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For over 20 years, the quarterly *Industry and Environment* has provided a forum for exchanging information and experience. Articles are contributed by industry managers, government officials, researchers and others active in the field of sustainable industrial development. Besides reporting on developments of broad international interest, each issue focuses on a particular theme. The themes of recent issues have included environmental management of industrial estates, product development, industrial accidents, mining, voluntary initiatives, service industries, and the agri-food industry. For a list of past issues and their availability, contact UNEP DTIE or visit http://www.uneptie.org/hp_division_office.html.

The next issue of *Industry and Environment* will focus on energy.

Industry and Environment is an English language publication, but it often includes articles in French and Spanish. All contributed articles are accompanied by summaries in English, French and Spanish.

The review is also available in Chinese.
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